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JULY

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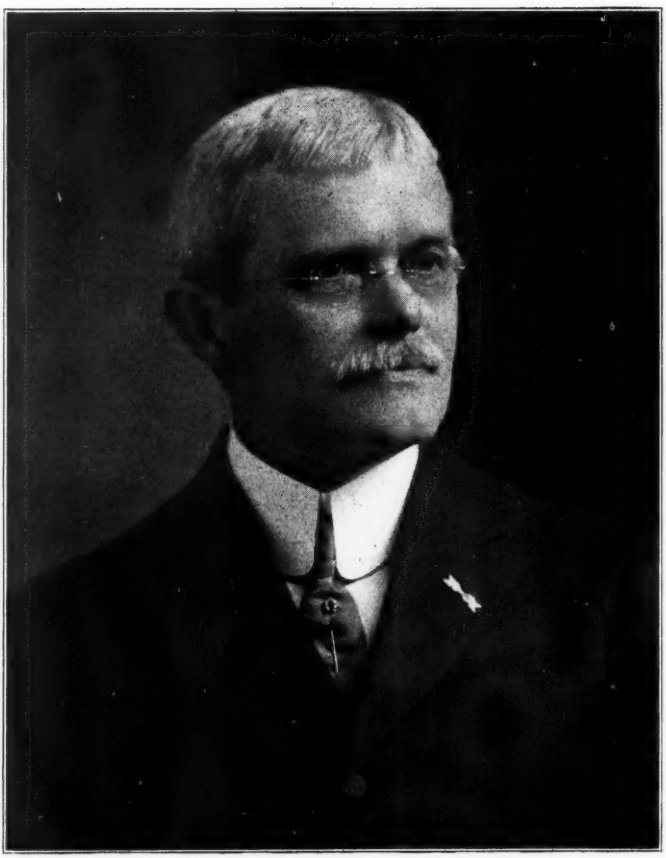

EDWARD CAMERON KIRK, D.D.S., Sc.D., LL.D., Philadelphia, Pa.
Editor of The Dental Cosmos, to whom a banquet was tendered recently on the anniversary of his fiftieth year in dentistry

THE JOURNAL
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Original Communications

FULL DENTURE CONSTRUCTION

By RUPERT E. HALL, D.D.S., Chicago, Ill.

IT is not the aim of this paper to attempt to cover every point in the construction of dentures, but rather to discuss some of the more important phases of the work. Following this article, there will appear in the next issue of THE JOURNAL another article by me entitled: "An Analysis of the Development of the Articulator."

POSITIONAL RELATIONS OF THE MANDIBLE TO THE MAXILLA; MOVEMENTS OF THE MANDIBLE AND THEIR REGISTRATION AND REPRODUCTION

The mandible is likened to the equilateral triangle (Bonwill) (Fig. 1) for the study of positional relations and movements.

The base of the triangle is described by a line connecting the condyles (condyle cord) and the sides by lines connecting the condyles with the contact point of the lower central incisors. The figure is used to illustrate diagrammatically positional relations of the mandible and the occlusions of the teeth, which are used as charts with which to make records of the adjustments of the articulator guides. The triangle is shown in solid and dotted lines, illustrating a right lateral relation to the left, a left lateral relation to the right and the protrusive relation in the center.

Positional relations of the mandible to the maxilla we define as the relations of the mandible to the maxilla when the teeth are in centric or eccentric occlusion or those relations that would maintain if the teeth were present.

Centric and eccentric occlusions of the teeth we define as follows:

Centric occlusion is the maximum contact of the occluding surfaces of the teeth when the mandible is in centric relation.

Centric relation of the mandible we define as the relation of the mandible to the maxilla when the mandible is in its retruded, unstrained position and closed somewhat beyond the rest position. In this position, the teeth will be in centric occlusion.

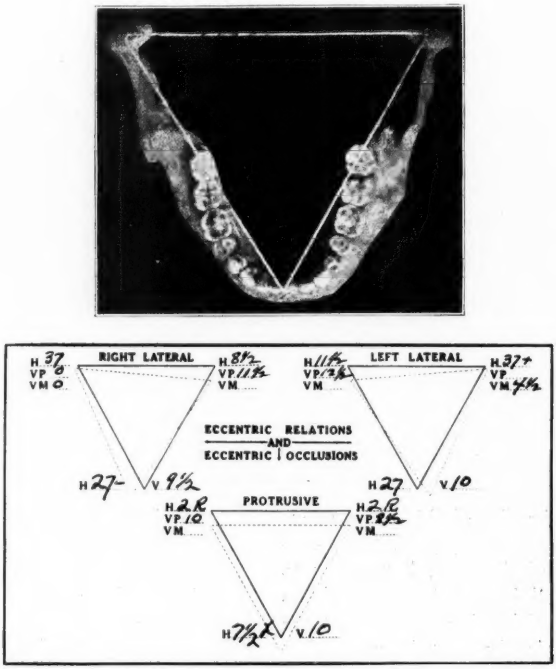


Fig. 1.—The Bonwill triangle. The readings of the adjustments of the guides of the articulator for the three registrations shown in Figs. 11, 12 and 13 (author's own case), are recorded in this figure. Such a record permits readjustment of the articulator guides to previous settings and provides data for study and future use. *H* at either of the points of the triangle stands for the horizontal reading of the adjustment of the respective guide in the horizontal plane. As the centering stops *A A A* (Figs. 11, 12 and 13) normally point in the direction in which the mandible moves, there is no record necessary as to which side of the dial the horizontal reading is taken from, unless it be in an exceptional case. This applies to the readings for the adjustments for either of the lateral relations of the mandible. The dials are numbered alike on each of their two sides; i.e., 0 to 50 in either direction from 0. This is necessary so the adjustments for either lateral relation will read from like figures. In the case of the protrusive relation, the three points of the triangle (condyles and incisor point) may move parallel with or to the left or to the right of the median or sagittal plane, as shown and further described in connection with Figure 13. To record such lateral deviations, the letters *L* and *R* are used to indicate the direction, *L* standing for deviation to the left and *R* standing for deviation to the right. The readings of the protrusive record give an example of the two posterior points moving to the right, and the anterior point moving to the left, which is not unusual. To transpose the graduations on the dials to degrees, multiply by 3.6. There are 100 graduations, making each equal 3.6 degrees. *V P* and *V M* stand for the vertical adjustment of the guides, plus or minus. If the guide in vertical movement adjusts with the centering stop *E* downward of the horizontal plane, this is plus (*V P*). If the guide adjusts with the stop upward, this is minus (*V M*). According to the record of the right lateral relation (Fig. 11), the anterior guide reads *H* 27 minus, and the right posterior guide reads *V P* and *V M* zero, while in the case of the record of the left lateral relation (Fig. 12), the left posterior guide reads *H* 37 plus. The minus and plus signs in the horizontal readings mean the indicator point lacked a little of being to the 27 mark in one instance and was a little past the 37 mark in the other. The zero means that the indicator point was at zero, registering neither plus nor minus.

Eccentric occlusions are:

A. Protrusive occlusion: Any occluded position of the teeth anterior to centric occlusion.

B. Retrusive occlusion: Any occluded position of the teeth posterior to centric occlusion.

C. Right and left lateral occlusions: Any occluded position of the teeth lateral to centric occlusion.

D. Intermediate occlusions: Any occluded position of the teeth between centric, protrusive, retrusive and right and left lateral occlusions.

Movements of the mandible we define as movements from one positional relation to another positional relation.

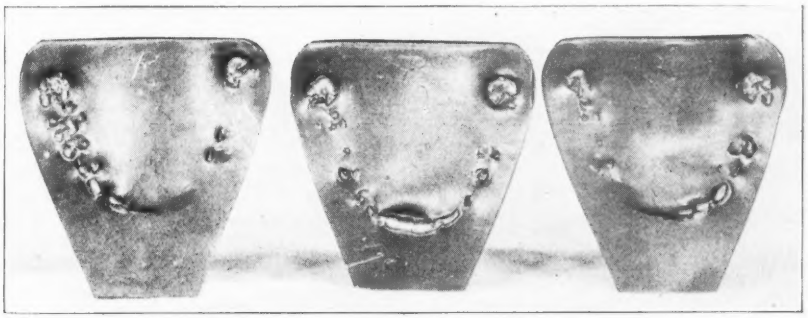


Fig. 2.—Wax-bite registrations of the left lateral, the protrusive and the right lateral positional relations of the mandible when the teeth are in lateral and protrusive occlusions.

Registering and reproducing positional relations of the mandible we define as means for the determination and fixation of these relations (with wax bites Figures 2 and 9, for example), and their subsequent reproduction with the guides of the articulator mechanism (Fig. 10).

To support and guide a body variable in its position and movements in three dimensions (maxilla in place of the mandible because of convenience), three supports and guides are required.

This is the fundamental principle underlying the construction of the articulator to be described. The upper arm of the articulator (maxilla) is supported and guided in its various positions and movements in three dimensions. Three individual universally adjustable supports and guides carried by the lower arm fix the upper arm in any positional relation and guide it in its movements from centric relation to eccentric relations, and vice versa.

THE UNIVERSALLY ADJUSTABLE THREE-DIMENSIONAL GUIDE

Figure 3 shows a ball through the center of which a hole has been drilled and a channel formed by removal of a section of the ball. In the center of the ball and channel, a small ball of the diameter of the bore of the hole is temporarily fixed. A second ball of like diameter is dropped into the channel in contact with the ball in the center and permanently fixed to form a stop or means for centering the middle ball, when freed to permit movement to and from centric relation.

Placement of the large ball in a socket, providing means to lock it against move-

ment, forms a three-dimensional guide assembly capable of fixing any positional relation of a point (middle or small ball) and forming the path of the movement of the point from one relation to another, and vice versa.

The centers of both the small and large ball are coincident. Any movement of the small ball from the center will be along some radius of the larger ball, and with this radius the axis of the channel can be adjusted to coincide, thereby fixing the positional relation and forming the path of the movement of the small ball (point) from one relation to another, and vice versa.

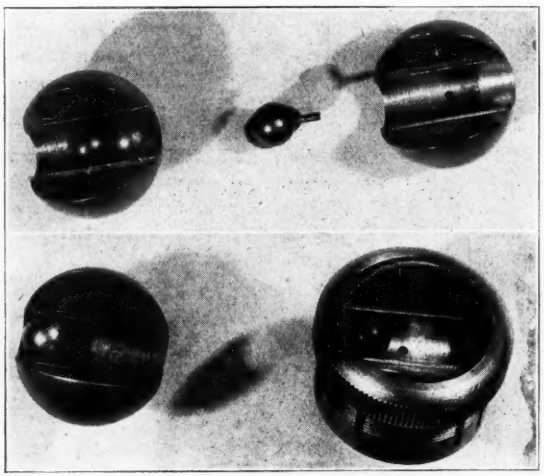


Fig. 3.—A universally adjustable three-dimensional guide.

Figure 4 shows a disassembled three-dimensional guide of different mechanical construction. This form of construction is desirable because its adjustments are calibrated and the readings may be noted and recorded for future reference in readjusting the guides when changing them from one adjustment to another. Records of the readings also provide data for study and future use.

For registering and reproducing positional relations and movements of the mandible, irrespective of the teeth, three three-dimensional guides are required in the articulator, one in the region of each of the two posterior points of the triangle and one in the region of the anterior point of the triangle.

Where there are natural occluding teeth present, anterior support and guidance are of no importance, and the anterior guide may, with regard to relations and movements, be dispensed with as in nature. There is no anterior guide in nature; here, the teeth determine the relations and direct the movements of the anterior point of the triangle, except in the horizontal plane in the protrusive relation, and likewise determine them in the three-dimensional articulator.

Anterior guidance is of value in connection with the three-dimensional artic-

ulator in arranging teeth in full denture work and in recording and reproducing the horizontal movement of the anterior point of the triangle in the protrusive relation and movement in cases in which the point deviates to the right or to the left (lateral deviation). In the latter case, a three-dimensional guide is required at this point in the articulator.

Should incisal guidance be desired for registering and recording positional relations and movements of the anterior point of the triangle in other directions than for lateral deviation, the three-dimensional guide fulfils all requirements.

For anterior guidance in full denture work, an arbitrary guide may be used (Fig. 5).

Figure 6 shows an articulator assembly embodying the three-dimensional guide construction illustrated in Figure 3 and the arbitrary guide shown in Figure 5.

Figure 7 shows an articulator assembly embodying the three-dimensional guide construction illustrated in Figure 4 and the arbitrary guide shown in Figure 5.

Figure 8 shows an articulator assembly embodying three-dimensional guide construction throughout, one three-dimensional guide in the region of each of the condyles and one in the region of the incisor point.

The name I have chosen for this instrument is "the three-dimensional articulator."

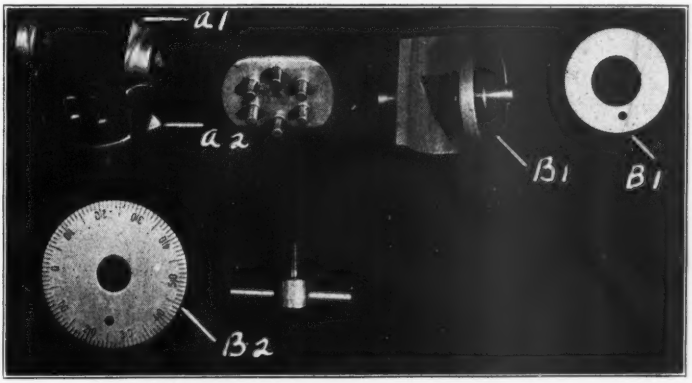


Fig. 4.—A disassembled three-dimensional guide with graduations for recording the adjustments of the guide. *A*1 and *A*2 show indicator points and *B*1 and *B*2 graduated dials from which readings of the adjustments of the guides may be taken for records, as illustrated in Figure 1. Indicator point *A*1 records the vertical adjustment on dial *B*1. Indicator point *A*2 records the horizontal adjustment on dial *B*2.

REGISTERING POSITIONAL RELATIONS OF THE MANDIBLE OF CASES WITH NATURAL TEETH AND REPRODUCING THESE RELATIONS WITH THE THREE-DIMENSIONAL ARTICULATOR ADJUSTED WITH WAX CHECKBITES

Securing registrations of positional relations of the mandible is a very impor-

tant and exacting procedure. Too much care cannot be exercised in this step.

Wax-bite registrations are fairly accurate for cases with natural teeth, but for full denture cases, owing to shrinkage and warpage of the wax and instability of the bases, there is probably no less reliable procedure ever practiced in denture prosthesis.

This practice has led to misinterpretations and incorrectly designed restorations amounting to no less than complete reversal of the actual conditions and design required in the case; i.e., with this method, cases have been determined to present reverse or minus condyle paths in protrusive relation and so treated, when in actuality they had normal or plus condyle paths.

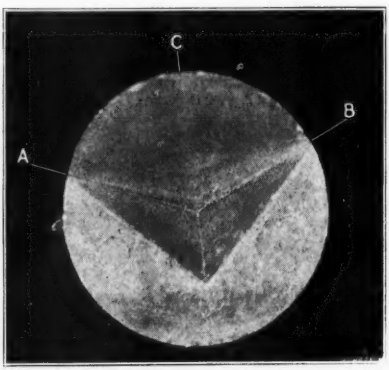


Fig. 5.—Arbitrary two-dimensional incisal pin guide. Angle *A B* (Figs. 5 and 6) directs alternate lateral incisal pin guidance coincident with the movement of the pin occurring from either posterior guide adjusted to the readings for the protrusive registration (Fig. 13). Vertically, the pin is directed transversally upon the inclined surface *C*, which is inclined 45 degrees to the horizontal plane, anteroposteriorly. In protrusive movements, the pin is directed to move 45 degrees to the occlusal or horizontal plane on the inclined surface *C*. The two-dimensional guide may be adjusted horizontally making it adaptable for unilateral and protrusive guidance, within limits. Horizontal adjustment of the guide, varying the angle of travel of the guide pin between *A* and *B* on the surface *C*, varies the angle of movement of the pin (opening movement) to the occlusal plane. Indicator point *A*3 registers the adjustments of the two-dimensional guide on graduated dial *B*2 (Fig. 7).

The wax-bite furnishes the only means thus far employed for registering relations of cases with natural occluded teeth. While this method is more accurate in these cases than it is in endentulous cases, it is still far from being accurate. In my efforts to check my own mandibular relations (natural teeth present), using the wax checkbite, I have been unable to secure two sets of bites that will give the same identical readings throughout on the dials of the articulator guides. The readings of the case recorded in Figure 1, those of my own case, are an average taken from the best bites that I could secure.

A satisfactory method for registering positional relations of edentulous cases will be given later on.

To know that we are absolutely recording and reproducing the relation of the casts to one another, checking the bite, as the checkbite directs (Fig. 9) with an articulator, the casts must be set into the bite as in Figure 9 without their relative positions being in any way predetermined or restrained by limiting connection and guiding articulator mechanism, as is the case in the use of an articulator having an intercondylar axis forming a hinge connecting the arms.

It is my pleasure to have been able to construct and to here present such an articulator.

Preparatory to checking or reproducing an eccentric positional relation, the guides of the articulator are released and adjusted so that the three points (ball members of the upper arm) may take any

position indicated when the casts are seated in the bite without the guides being in contact with the balls. Such a mechanism permits the casts to absolutely seat themselves in the bite, after which the guides are adjusted to the balls (Fig. 10). In this illustration, a view is had of the adjustments of all three of the three-dimensional guides. The individual requirement of and the adjustment for each of the three points of the triangle is demonstrated.

Movement of the ball on the working side is sometimes so slight as to make accurate adjustment of the guide difficult. In fact, the center of the ball may happen to be the center of the movement, requiring no adjustment.

It is seen that what we are doing in this newer work is checking positional relations and reproducing the movements of the mandible as a whole. The older idea and practice of trying to locate the positions and to determine the movements of the condyles and the incisor point (gothic arch) is disregarded.

Registration of positional relations and reproduction of the movements of the mandible as a whole establishes the condyle paths and the gothic arch automatically.

Fig. 6.—An articulator assembly embodying the three-dimensional guide construction, illustrated in Figure 3, and the arbitrary guide illustrated in Figure 5.

SELECTIVITY

The articulator mechanism shown is selective; i.e., starting with centric relation, one eccentric relation and movement only can be recorded and reproduced at a time. Figures 11, 12 and 13 show, respectively, the right lateral relation, the left lateral relation and the protrusive relation.

No mechanism has yet been devised, with which I am familiar, that accurately

records and reproduces alternate mandibular relations and movements in both the balancing and working relations and the protrusive relation with one adjustment.

The three-dimensional articulator is the first to provide guides universally adjustable to record accurately positional relations of all three points of the Bonwill triangle in three dimensions, simultaneously.

There is no articulator, nor will there ever be an articulator, that will accurately reproduce the movements of the mandible. These movements are individually characteristic of a human being; they are not mechanical in the sense of a machine, nor will they ever be reproduced with a machine. The three-dimensional articulator accurately records and reproduces positional or fixed relations of the mandible, according to checkbites, but

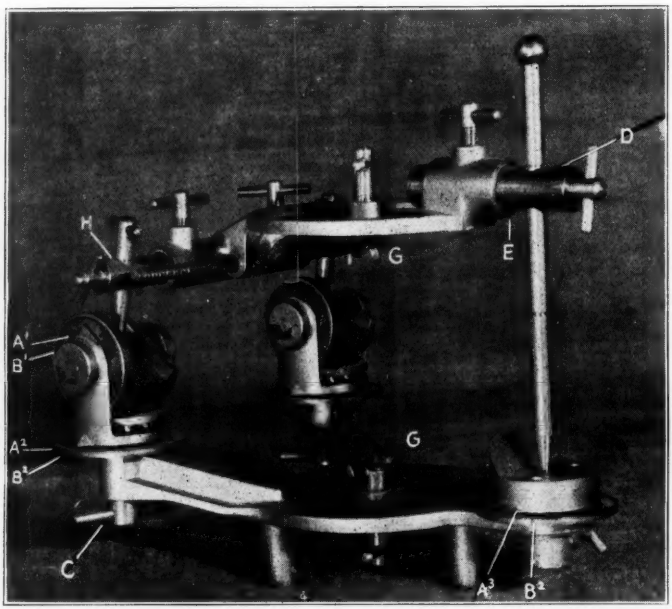


Fig. 7.—An articulator assembly embodying the three-dimensional guide construction illustrated in Figure 4, and the arbitrary guide illustrated in Figure 5. Indicator points *A*1, *A*2 and *A*3, and graduated dials *B*1 and *B*2, record each of the two adjustments of the three-dimensional guides and the one adjustment of the two-dimensional guide. The adjustments of the universal movement of the three-dimensional guide are controlled with a unique looking device operated by a single draw screw *C*. Loosening the screw permits adjustment of the guide to any position horizontally and vertically. Tightening the screw locks the guide securely. Wing nuts *G G*, attached to the armplates, become a part of the casts when mounting and provide means for detaching and reattaching the casts (Figure 9 shows casts removed from the articulator). The wings of the nuts are bent diagonally with the pliers in opposite direction, resembling a propeller. This prevents them from pulling out of the plaster.

not its movements. It approximately reproduces the movements of the mandible, and this is all that any other articulator does or ever will do.

I introduced the three-dimensional articulator to the profession at the Philadelphia meetings of the National Society of Denture Prosthetists and the International Dental Congress in 1926, and it has stood the test of time since then and will so stand for all time to come. Nothing more is required and nothing less will answer the purpose.

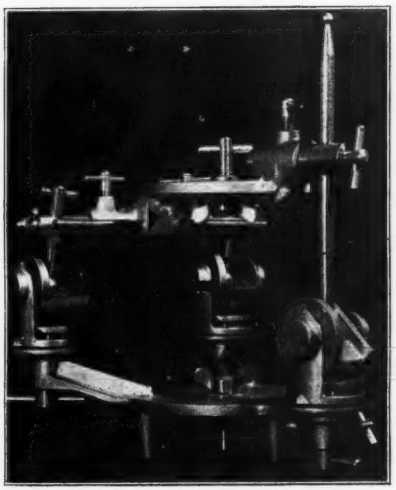


Fig. 8.—An articulator assembly embodying the three-dimensional guide construction throughout, one three-dimensional guide in the region of each of the condyles and one in the region of the incisor point.

John A. Lentz, Phoenix, Ariz., was given a patent in 1925 with claims covering the three-dimensional guide principle herein described (Fig. 14). While Lentz's work antedates that of mine in this respect, my work was done without knowledge of Lentz's work, it being only recently cited by the patent office in connection with patent application papers.

It is regrettable to note and to have to call attention to the fact that C. J. Stansbery, in his article "Functional Position Checkbite Technic"[1] took full and complete credit for the three-dimensional principle in articulator construction. His actions in this matter are inscrutable and inexcusable.

A letter from Dr. Stansbery to me, dated Sept. 17, 1928, reads in part as follows: "I am in receipt of a letter from Dr. J. E. Storey, Beaumont, Texas, asking, 'Where may I obtain the three-dimensional instrument that you mentioned in your paper read at Detroit?' I answered, 'The only universally adaptable instrument that I know of is made by Dr. Rupert E. Hall, Pittsfield Bldg.,

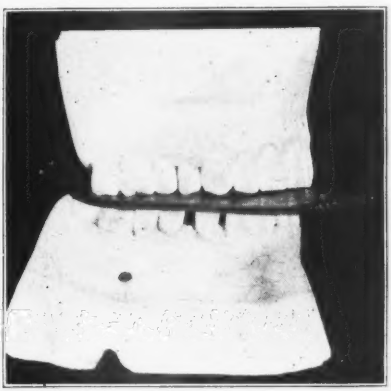


Fig. 9.—Casts of the teeth in right lateral occlusion according to the right lateral wax checkbite, Figure 2. The casts are set in the bite in the relation called for by the registration; i.e., no articulator mechanism prevents the casts from going to absolute place in the bite.

1. Stansbery, C. J.: J. A. D. A., 16:421 (March) 1929.

Chicago, and may be had from him direct.' "

In the face of the foregoing, Stansbery did not even mention my name in his entire article, an offense demanding correction by way of apology to both me and the profession, and also to Lentz, if Lentz's work was known to him.

It may be mentioned that, in the same issue of THE JOURNAL, there appeared an advertisement of an articulator "designed by Dr. C. J. Stansbery," calling attention to Dr. Stansbery's article in the same issue.

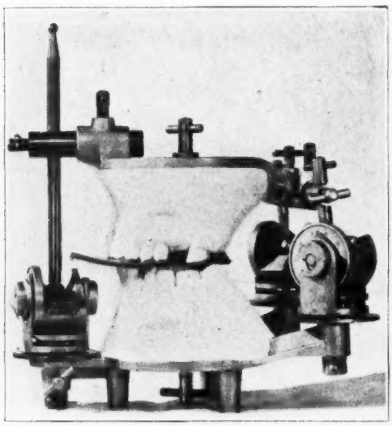


Fig. 10.—Casts mounted in the articulator in left lateral occlusion according to the wax bite, Figure 9 (the stops *E E E* are pointing to the left), preparatory to adjusting the guides of the articulator to record and reproduce the relation as registered by the wax bite. The casts are set in the bite in the absolute relation called for by the wax registration as in Figure 9; i.e., no articulator mechanism prevents the casts going to absolute place in the bite. The guides are released and adjusted so that the three points (balls) may take the required position without the guides being in contact with the balls, after which the guides are adjusted to the balls.

I have an investment covering the development of the Hall three-dimensional articulator and a stock of these instruments stored in my basement, and I have yet to advertise or solicit sale of the instrument. In fact, I have discouraged its sale.

I do not believe any adjustable articulator is a practical instrument for use in the hands of the average dentist in everyday practice. I think more and greater errors will be made in using an adjustable articulator than will be made with a good average arbitrary instrument. It will be recalled that I took this stand before I

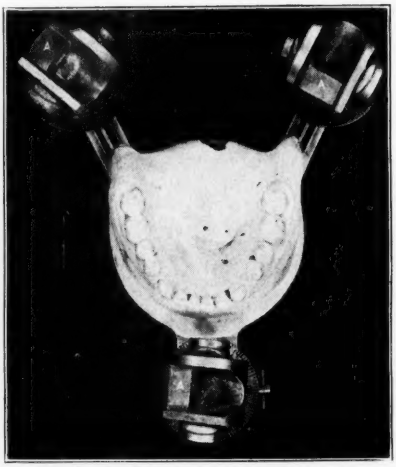


Fig. 11.—Guides adjusted for the right lateral relation (right lateral because the stops *A A A* are pointing to the right side of the mandible). With the stops toward the right, the ball members of the guides (upper arm of the articulator) may be moved in the opposite direction or to the left, effecting movement of the lower arm (mandible) to the right.

designed and built the three-dimensional articulator and I still maintain that such is the case. In fact, I am more sure of it than ever. If there is a need and a demand for an adjustable articulator, the three-dimensional instrument is the artic-

ulator. It meets every requirement made of an articulator.

The adjustable articulator and methods of its use have proved an absolute failure from the standpoint of adoption and use by the profession as a whole. According to my observation and belief, not more than 1 per cent, if that many, of the profession consistently make use of an adjustable articulator and of the best methods available for its application. In fact, some of our denture men do not themselves and in this connection are not consistent—they talk and write one thing and practice another. I have been in their offices and have observed this to be true. Some make no effort to cover up the fact. One man prominent in the work made the statement to me: "These things (adjustable articulators, etc.) are fine and I

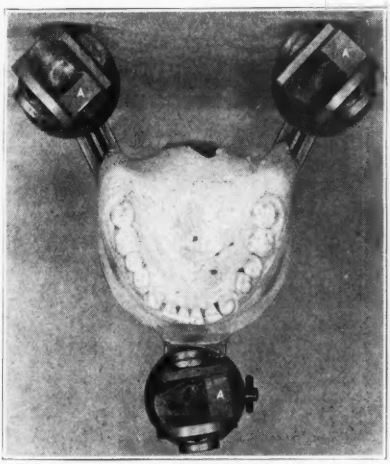


Fig. 12.—Guides adjusted for the left relation (the stops *A A A* are pointing to the left).

believe in them, but I have to get the work out and get the money. My patients will not pay the fee to justify their use and I have not the time to bother with them." Strange to say, these men and the profession as a whole are not so far off or so wrong as it may seem. Some of us, I for one, who have been consistent in the use of these things have concluded,

Fig. 13.—Guides adjusted for the protrusive registration (protrusive relation because the stops *A A A* of the guides are pointing to the front). Adjusted to this registration, the two posterior guides are normally parallel, or approximately so, with one another and will give the same horizontal reading. The guides adjusted for this relation are not necessarily parallel with the median plane of the instrument. A deviation to the right or to the left is often recorded and indicates that the condyles may move to the right of the median plane as they move forward. This we term the lateral deviation, as recorded and further explained in Figure 1. The incisor point is also found to register lateral deviation and to deviate independently, both in direction and degree to the condyles; i.e., the condyles may move to the right in the same degree or varying degrees and the incisor point may move to the left, in varying degree, as shown in this view and recorded in Figure 1. The movements of the three points of the triangle vary with one another in both the vertical and the horizontal plane, as recorded in this case in Figure 1. For the complete record of the readings of the adjustments shown in this view, see Figure 1.

as will be fully considered farther on in the paper, that there is something wrong with the work and that we are not accomplishing so much as we thought we were the use of all the equipment and procedures necessary to the construction of dentures in strict compliance with modern methods, so considered.

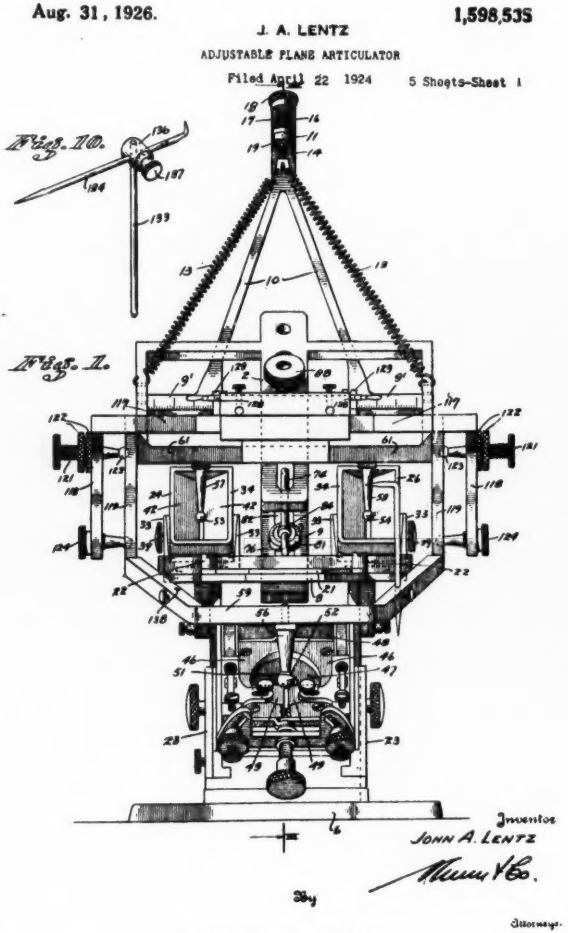


Fig. 14.—Lentz articulator.

and as our patients are entitled to receive in this work.

I, too, have found that the public at large is not willing to pay a fee to justify

I know of nothing in any of the arts or trades that is so indifferently and poorly executed as are full denture restorations. And the hardships that this state

of affairs imposes on those of the profession that are giving their all to this branch of dentistry is very unfair to them and to the unfortunate patients needing and seeking this service.

The denture man must have fees commensurate with the skill and time demanded of him in this class of work.

There is absolutely no comparison between dentures that are made the every-day commercial laboratory way (90 per cent of them are made this way, we estimate) and some of the better dentures that are being made by men that are specializing in or that are featuring this work. And yet the denture man is confronted everlastingly with the same question "Why do you charge so much for dentures and why do you take so long to make them?"

The first requisite in the restoration of occlusion, the establishment of centric relation of the mandible and centric occlusion of the teeth between and throughout the entire twenty-eight teeth, is not obtained in 1 per cent of the dentures delivered to patients, without excessive grinding. The relations of the teeth to the ridges with regard to leverage and arch form is not carefully studied and established, and esthetics is almost entirely lacking. All of these more simple and important considerations and requirements are in order for more serious study and improvement before we are ready for an adjustable articulator. They are the A B C's of the subject and must be mastered before we are ready for and will be capable of employing an adjustable articulator. Too many have been under the impression that an adjustable articulator will do the work for them, and far too much credit has been given to the use of articulators. Many troublesome cases around the country have supposedly been successfully constructed by using this or that articulator. Other cases have been likewise improved or made perfect by mounting them in this or that articulator and correcting the occlusion, supposedly.

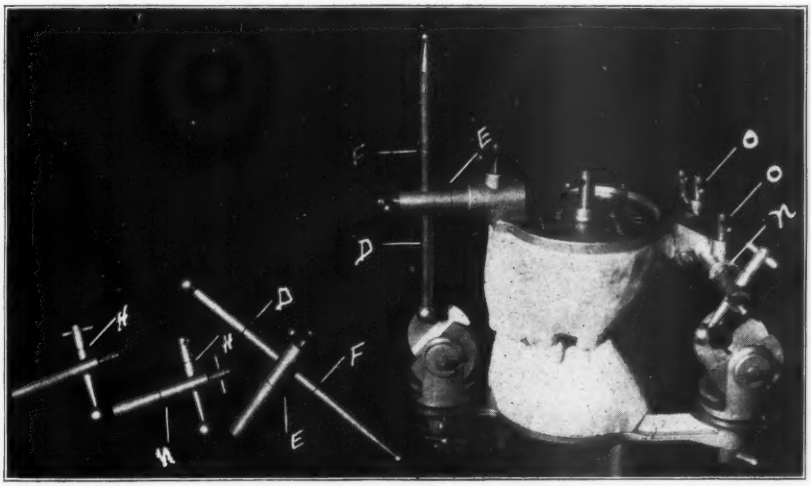


Fig. 15.—Adjustments for centric relation or centric occlusion.

That which was done in the latter cases, in most instances, was a correcting of centric occlusion by grinding away the cusps; which could have been done just as well in a plane-line articulator.

STANDARDIZATION A PRACTICAL AND ECONOMICAL REQUIREMENT

I have given my undivided time, day and night, for fifteen years, the very best years of my life, to intensified study of and application to the one dental problem, that of making a better set of dentures and standardizing denture prosthesis. In this time, until recently, I doubt that I have made two sets of dentures using the same identical technic throughout, striving always to perfect an equipment and procedure that would improve this and that feature in the construction of each succeeding case. And, after fifteen years, I have been able, finally, to perfect an equipment and technic that has proved sufficiently practicable, efficient and economical to warrant adoption. It is in celebration of this achievement that I have prepared and present this paper.

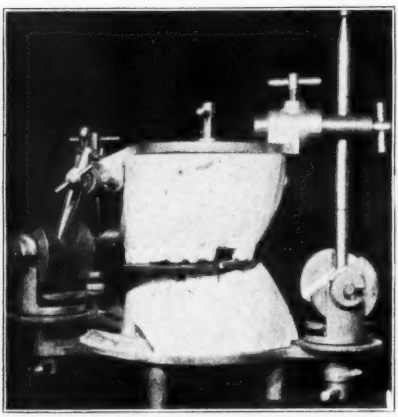


Fig. 16.—Adaptability of the adjustments for centric relation or occlusion. The casts were simply turned around in the articulator (not remounted) and centric occlusion was reestablished with the adjustments. This view also shows that the facebow is nonessential with the three-dimensional articulator.

I now hope to have time for indulgence in some of the pleasures of life of which this work has deprived me, and to become better acquainted with the members of the profession, whose more intimate friendship and association I have missed and should like to enjoy.

I have been solicited in the past to write a textbook on the subject of denture construction and have two contracts that were submitted for my approval and signature. My answer to these solicitations has always been "I do not know enough to write a book." And, considering the many times that I have changed my technic and opinions, it has proved a very wise and consistent stand for me to take. Some time in the future, I may consider the matter of writing a book, if, in the meantime, my methods and technic have stood the test of time and I am convinced that publication of a textbook is justified.

ADJUSTMENTS FOR CENTRIC RELATION OR CENTRIC OCCLUSION

A new, scientific and practical feature of the three-dimensional articulator is adjustments for centric relation or occlusion (Fig. 15). The adjustments for these relations eliminate the necessity of remounting a case when the centric relation or occlusion of the casts (bite) is changed, either vertically or horizontally or both, from any cause whatsoever.

Figure 16 shows the adaptability of the adjustments for centric relation or occlusion. The casts were simply turned around in the articulator (not re-

mounted) and centric occlusion was re-established with the adjustments.

The adjustments are shown released, disengaging the ball ends from the guides. With the teeth fixed in centric occlusion or the bite rims fixing the casts in centric relation, the balls are adjusted in their seats in the guides and secured with the set screws.

The stripes or grooves on the parts indicate the positions at which they are set when the articulator is adjusted preparatory to receiving a case, as shown in Figures 7 and 8.

(Figs. 7 and 8), and allowed to adjust or seat themselves automatically in the guides. The stripe *n*, Figure 15, on the one holder stem, is placed even with the edge *N* of the bearing housing, when the set screws *O O* are tightened, which completes the adjustment.

No facebow or auxiliary equipment commonly advocated and used for the transfer of the casts to the articulator is necessary with the three-dimensional articulator when the guides are adjusted direct with checkbite registrations. Once the principle of the three-dimensional guide is understood, it will be obvious that the positional relation of the casts to the articulator mechanism (guides) is of no importance in the checking of positional relations of the mandible. The same practical results are obtained from an arbitrary mounting as from a facebow mounting. I will discuss the facebow in another paper.

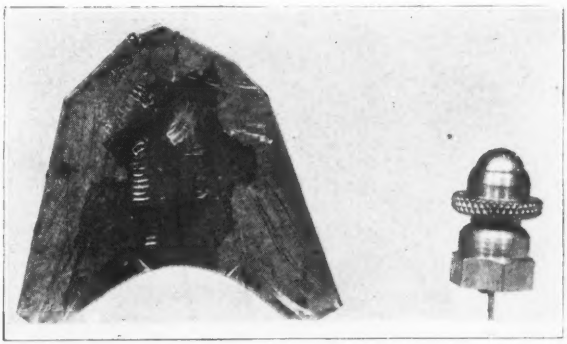


Fig. 17.—A ball unit and bearing plate for stabilizing dentures for testing the occlusion, using the mouth itself as the articulator.

When adjusting the articulator to receive a case using the two dimensional incisal guide (Fig. 5), the small ball end of the guide pin is adjusted to engage therewith, the pin being set at the stripe *D* vertically (Fig. 7), and the holder stem at the stripe *E* horizontally. When the three-dimensional guide is employed for incisal guidance, the large ball end of the guide pin is used, the pin being set at the stripe *F*, Figure 8. With the guide pin adjustments secured and the two posterior ball points adjusted and secured at the stripes *H*, Figure 15, the three ball points are positioned in the guide seats

Figure 16 shows the guides adjusted to a right lateral registration with the casts mounted crosswise in the articulator, demonstrating the absolute adaptability of the instrument and the fact that the facebow is nonessential.

REGISTERING POSITIONAL RELATIONS AND REPRODUCING THE MOVEMENTS OF THE MANDIBLE IN EDENTULOUS CASES FOR THE CONSTRUCTION OF FULL DENTURES

C. J. Stansbery, Seattle, Wash., is the author of the method recommended for registering positional relations of the mandible.[1] This method is by far the most scientific, practical and accurate of all yet devised. It is the first to take cognizance of the opening movement (depth of the cusps and overbite) registering eccentric relations of the edentulous mandible that obtain when the teeth are inserted. We are deeply indebted to Dr. Stansbery for this contribution. Before the advent of the Stansbery intra-oral checkbite technic, a fully adjustable articulator was worthless because there was no means at hand with which to determine the patient's mandibular relations to guide us in making the necessary articular adjustments required to reproduce their relations. The same is true in regard to the three-dimensional articulator; for without it the Stansbery checkbites cannot be checked. Each is indispensable to the other. The Gysi extra-oral method of registering mandibular relations falls far short of meeting the requirements. The intra-oral versus the extra-oral method of registering mandibular relations will be discussed by me in another paper.

Stansbery utilizes the principle of the central bearing point in securing registrations that was given us by George P. Phillips, of Boston, Mass. Dr. Phillips demonstrated the use of the central bearing in the form of a ball engaging with the surface of a plate in securing registrations of mandibular relations confined to movements of the edentulous mandible in the horizontal plane or those movements not influenced by the cusps of the teeth and overbite, the function of the ball and plate (central bearing point) being the same as that shown and described by Stansbery. We are also deeply indebted to Dr. Phillips for this indispensable contribution; for it is indeed indispensable in this connection.

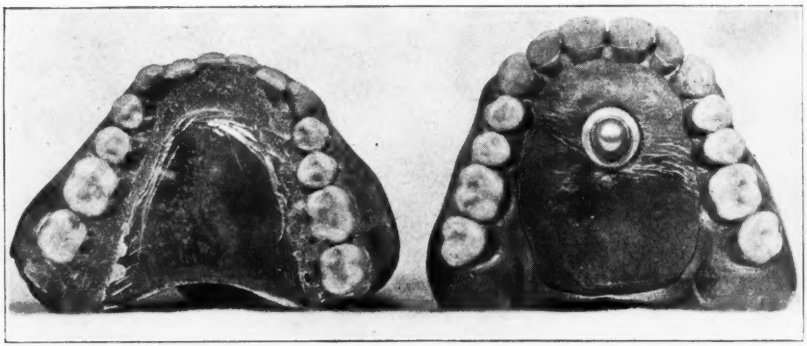


Fig. 18.—Ball unit and bearing plate secured to the dentures with modeling compound.

Having secured the checkbites, the casts are next mounted in the articulator.

MOUNTING THE CASTS IN THE ARTICULATOR

The casts, secured in the centric relation (bite), are mounted in the articulator arbitrarily.

ADJUSTING THE ARTICULATOR GUIDES

The guides of the articulator are adjusted respectively to the lateral and protrusive registrations, in the order named (illustrated in Figures 11, 12 and 13), and the readings of the adjustments of the guides for each registration recorded, as illustrated in Figure 1.

ARRANGING THE TEETH

The teeth are tentatively arranged to approximate balance with the posterior guides of the articulator adjusted in accordance with the readings for the protrusive registration (Fig. 13) and the incisal guide pin adjusted to the arbitrary incisal guide (Fig. 5).

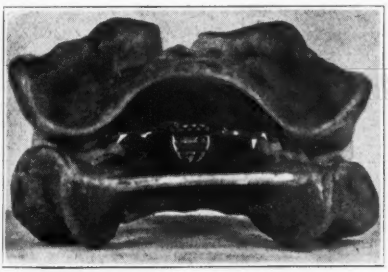


Fig. 19.—Ball unit and bearing plate in position with the dentures in centric occlusion.

With the posterior guides adjusted in accordance with the readings for the protrusive registration, and the incisal guide pin adjusted to the arbitrary incisal guide, the upper arm of the articulator is free to move up and down, backward and forward and to either side, and the movements will approximate those of the mandible in the given case. The movements of the articulator in the condylar region in this case are identical with those of the Snow articulator, as a specific example, with the exception of the added improvement of registering the lateral deviation of the posterior points of the triangle (condyles) shown and explained in connection with Figures 13 and 1.

Preparatory to setting the teeth, the bite of the articulator is opened with the incisal pin the amount it is estimated the bite will be closed in grinding in the teeth after vulcanization, grinding to the original bite instead of away from it. I demonstrated this point at the January meeting of the Chicago Dental Society in 1927, grinding in a set of dentures for Dr. George H. Henderson.

Following the tentative arrangement of the teeth with the articulator moving universally, as described, the arrangement of the teeth is perfected in each of the three registrations, name-

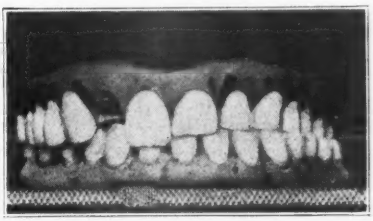


Fig. 20.—Example of a set of dentures in which the bite was missed and the patient wore them regardless. This view demonstrates that the occlusion of this set of dentures improved with use.

ly, protrusive and right and left lateral relations. Protrusive occlusion is first perfected by adjustment of the anterior three-dimensional guide for observance of the influence and requirement of individual guidance of the anterior point of the triangle (incisor point) as shown and explained in Figures 13 and 1. The occlusion in the two lateral relations is next perfected by adjustment of the guides for observance of the influence and the requirement of the individual readings for either lateral relation (Figs. 11 and 12).

GRINDING IN OCCLUSION

Following vulcanization of the dentures, they are returned to the articulator and ground to balance with the three-dimensional guides adjusted first to the protrusive registration, and then to the right and to the left registration as in arranging the teeth. The original mounting of the case in the articulator is preserved by the use of Austin's stone casts, which are returned to the plaster mounting seats left in the articulator; a very accurate and indispensable step for which we are indebted to Dayton D. Campbell.

It is seen by the foregoing that the principal difference in the three-dimensional articulator and the technic of its use over other articulators and technics is that the true lateral relations of the mandible are determined and the teeth arranged and ground to so conform after all other operations are completed. Thus, the inability of the instrument to move from side to side when adjusted to one lateral registration imposes no inconvenience on the operator. The adjustment for the protrusive relation, permitting the customary universal movement, suffices for all practical needs up to the point of the final arrangement and grinding in of the dentures in right and in left lateral occlusion.

PERFECTING OCCLUSION OF THE TEETH TO A DEGREE NOT POSSIBLE WITH ARTICULATORS AND HERETOFORE UNATTAINED

Because of the inability of the prosthetist to determine and to imitate the precise movements of the patient's mandible between positional relations with

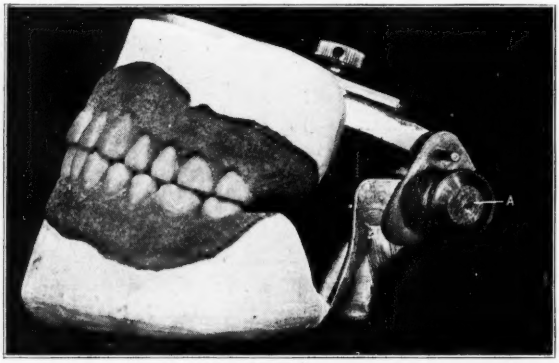


Fig. 21.—Inverted cusp teeth, the occlusal form or surface of which is without projections (cusps) that interlock with their antagonists (occluding teeth). A simple occlusal surface with masticating efficiency is thus effected, doing away with articulation and also with the need for recording mandibular relations and using adjustable articulators.

articulators and the inaccuracies in general that creep in, it is necessary that the natural moving jaw be utilized in perfecting the occlusion of artificial dentures. The difficulty experienced in the past in using the moving jaw itself for this purpose lay in the fact that the dentures are too unstable to resist the displacing forces of interfering points. The particular feature of the method to be shown is that it stabilizes the dentures, holding them firmly in position about

the jaws so that the occlusion may be examined and perfected throughout its various ranges.

The method consists of the utilization of the central bearing principle given us by Phillips and used in the Stansbery checkbite technic.

This method, which belongs to me, consists of a threaded, adjustable ball unit and bearing plate (Fig. 17). The ball unit is secured to the finished upper denture with compound and the bearing plate is likewise secured to the lower

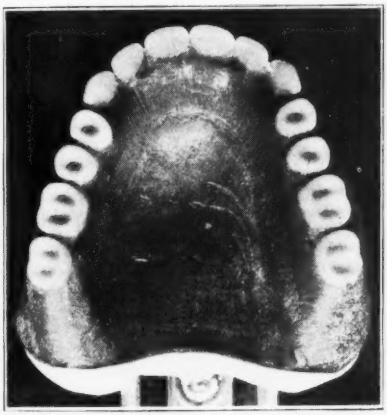


Fig. 22.—Occlusal view of a set of upper inverted cusp teeth.

denture (Fig. 18), centralizing the contact point of the ball with the plate approximately at the centers of the circumscribed areas of the two baseplates, with the two dentures in full centric occlusion (Fig. 19). The screw stem carrying the ball is now lengthened by unscrewing the stem to such an extent that the ball riding upon the surface of the bearing plate will hold the dentures apart or out of occlusion and at the same time hold them firmly in place about the respective jaws when placed in the mouth. The patient is instructed to close the jaw, establishing contact between the ball and plate, and to move the mandible in all directions possible, maintaining contact of the ball with the plate. The ball stem is now screwed up and thus shortened; which permits closure of the jaw until the patient, continuing to move the jaw, feels the first point or points of contact between the teeth. Carbon paper is used to carbonize the points of contact, the dentures are removed from the mouth and, with the stone in the handpiece, the points are ground away.

The ball stem is again screwed up or shortened more, the dentures are returned to the mouth and the patient is instructed to move the mandible in all directions. As before, all points of contact are carbonized and reduced with the stone, and, so on, inharmonious high points being progressively reduced and balance established in the various vertical elevations as centric occlusion is approached. The balance of the dentures is thus perfected to a degree not possible of accomplishment with articulators and heretofore unattained as a practice.

DIRECT GRINDING OF THE OCCLUSION BY HAVING THE PATIENT CHEW CARBORUNDUM

Chewing carborundum is recommended because it will improve the occlusion of any set of dentures. It will grind in the dentures in the conditions under which they function, compensating for the inimitable movements of the mandible between positional relations and of the dentures upon the yielding supporting tissues.

I now come to a more concrete pronouncement in connection with this whole question of full denture construction. As will develop later, I now affirm it as my pronounced conviction that with the very best intentions many of our full denture

efforts—mine with the others—have been along the wrong lines and on a false foundation. I, in common with others, have worked on the assumption that the highest expression of art and efficiency in full denture construction consisted in imitating nature, and the nearer we came to doing this, the greater credit we took to ourselves. We lost sight of one fundamental fact: that the moment the natural teeth are extracted, the conditions in the mouth are irrevocably changed for the future lifetime of the patient. It is one thing to study the philosophy of occlusion in the natural teeth when they are anchored in the bony structures of the jaw, and it is entirely another thing to study occlusion of artificial teeth when the teeth are supported by a baseplate resting against jaw tissue. We must reconstruct our conceptions of the needs and possibilities of artificial denture service, and forget much of the theorizing that we have been indulging in during recent years. In doing this, we may suffer the penalty of slight humiliation, but we may better do this than go on repeating mistakes of the past. We at least may claim that we have worked conscientiously and to the best of our ability with the light which we possessed.

Fig. 23.—Occlusal view of a set of lower inverted cusp teeth.

MODERN DENTURE PROSTHESIS, SO-CALLED, OVERSPECIALIZED AND A FAILURE

An enormous amount of work and money have been expended in and on the subject of full denture prosthesis in an attempt to imitate mandibular movements, balance occlusion and stabilize dentures, and it is regrettable that we find, in the end, that our results do not justify the effort.

We have been working along the wrong line. Our work is without the first requisite: a foundation. The tissues supporting full dentures, forming the foundation on which depends the permanency of the work, atrophy; and as a result of this tissue change the mandible and dentures change their relative position, and our

finely perfected scheme of occlusion is lost and from then on is a detriment rather than an advantage.

Rebasing, regrinding, etc., in an attempt to compensate for these changes have proved to be just another disappointment, the same condition recurring repeatedly until there is nothing left to work on, at which point both the patient and dentist find themselves confronted with the question: "What is being accomplished and what is it all about?"

I have become firmly convinced that the so-called modern denture prosthesis of the day is founded on the wrong premise and that practice based on it is a failure.

Fig. 24.—Master cast of an upper jaw mounted in a ring preparatory to duplicating the cast.

Fig. 25.—Another ring placed on the first ring (Fig. 24) and around the cast.

Occlusal restorations that undergo change in positional relation with their antagonists, owing to settlement of the restoration and resultant change of positional relation of the mandible to the maxilla, are not satisfactorily restored with cusp teeth imitating natural teeth in form.

The reestablishment of occlusion with restorations subject to these changes presents a problem entirely different from that of other dental problems.

The old time dentures with shallow cusps or practically no cusps at all, and with what cusps there were occluding end to end, became a part of and remained a part of the patient for life—growing better as time went on. Never being in correct relation, these dentures could only get better, not worse. In Figure 20 is an example of a set of dentures in which the bite was missed about one-eighth inch to the side and the patient used them and wore them regardless. This view demonstrates that the occlusion of this set of dentures improved with use.

Modern dentures, assuming that they are in balanced occlusion, begin immediately to lose their finely balanced relations and progressively get worse. In fact, they are well on their way to condemnation from the beginning as but an occasional case is perfectly balanced, the problem of perfecting balance presenting greater difficulty than the dentist is able to master.

I once used and advocated deep cusp teeth. I now believe teeth without any cusps at all to be the answer to the problem and that all of the past work, dealing with cusp teeth, articulators, etc., including that done by me and discussed in the previous pages of this article, is based upon the wrong premise and must be passed into the discard.

If cusp teeth are to be used, it is my belief that the less intimately the cusps

are articulated (interlocked), by way of the customary grinding in with articulators and grinding devices, the more efficient and certainly the more permanent will be the results. A very limited amount of spot grinding is all that I have employed of late.

Three years ago, I was called on to extract the teeth of my own mother, then 76 years old, and to construct a full set of dentures for her. She lived more than a thousand miles away, and realizing that I could not service the case (service the case, think of that!) as I could if she were near me and that the customary rebasing, regrinding, etc., would be required, I awakened to a feeling of desperation in my wonderment as to how I was to cope with the situation. Realizing and believing as I had for some time that interlocking cusps were the stumbling block in the work and that the old time end to end occluded dentures never required rebasing or grinding, I set out to construct something for the case along entirely different lines and made for her a cuspless or inverted cusp set of dentures, which today are as they were when inserted—satisfactory in every particular. The case has twice been inspected in the last year and there seems even to be no consciousness of wearing dentures. This result, bear in mind, too, was attained upon jaws where the teeth were freshly extracted. It is not believed that this result could be reported had the other plan of occlusion been employed, balanced or otherwise.

In fact, the best of jaws, from which the teeth have long since been removed and the healing process completed, break down and go to ruin under the abuse inflicted on them when interlocking, interfering cusp teeth are employed.

An axiom may be stated as follows: The greater the depth of the sulci and interlocking of the cusps and the more intimate or perfect the occlusion (grind in), the greater the trouble to follow.

The name I have chosen to give this new form of cuspless tooth is the inverted cusp tooth.

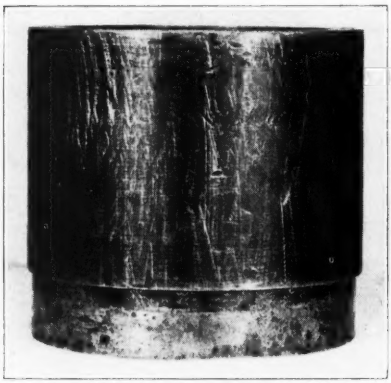


Fig. 26.—Another ring with a recess forming a seat which telescopes and rests upon the first two rings, shown in Figure 25.

Fig. 27.—The ring shown in Figure 26 filled with paraffin.

THE INVERTED CUSP TOOTH

Figures 21, 22 and 23 show the inverted cusp teeth, the occlusal form or surface of which is without projections (cusps) that interlock with their antagonists (occluding teeth). A simple occlusal surface with masticating efficiency is thus effected, doing away with articulation and also with the need for recording mandibular relations and using adjustable articulators.

Following is a quotation from the book of George A. Dorsey, formerly curator of the Field Museum, entitled "Why We Behave Like Human Beings,"

Fig. 28.—Paraffin mold secured from the ring shown in Figure 26.

in which he calls attention to the inefficiency of even the human teeth.

> Without further details of fetal development it will be worth while to recall certain variations in the system of digestion, respiration, and circulation, which are significant in the light of our animal ancestors.
>
> Our dentition is as well adapted for spinach as for beefsteak, specialized for neither. Our front, or incisor teeth, are only fair cutters; our bicuspids, or premolars, are not strong enough to crunch bones; our grinders, or molars, are not very good millstones. Our snarling muscle discloses no such canines as the flesh-eaters stab and tear their prey with. Our teeth are on the go. A perfect "civilized" set is rare.

There is a machine on the market for grinding either wet or dry substances, such as wood pulp, rags, bones, grain or in fact any substance, employing the principle embodied in the inverted cusp teeth and which I am informed is the best mechanical principle yet devised in this line of endeavor. The application of this principle in the grinding machine consists of two spaced, opposing revolving disks, rotating in opposite directions. The opposing surfaces of the disks contain a multiplicity of cups, the peripheries of which form a series of cutting edges, which, in vertical relation, intersect each other, exactly like occluded inverted cusp

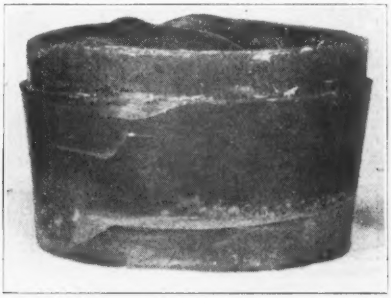


Fig. 29.—Ring shown in Figure 25 removed from around the paraffin mold shown in Figure 28.

teeth. Centrifugal pressure forces the substance being ground in the machine between the revolving disks, in and out the cups, grinding it to the fineness desired as it passes between them according to the spacing between the disks.

In the following, I will give a brief outline of the technic that I now employ in connection with the use of the inverted cusp teeth; which, with the exception of the equipment for taking the bite and the technic of its use, is as simple as the most simple means and technic ever employed in the making of dentures. It is hoped

that the bite equipment and technic can be simplified in the future.

IMPRESSION TAKING

The best all-round, most satisfactory and practical impression, and the one finally settled on and adopted in my practice as such (it is to be understood that I concede the virtue of and use other impression materials and technics), is made with the individual compound tray, made with impression tray compound, devised and introduced by me, and "truplastic," an efficient and practical material specially made for taking impressions, from the formula of T. A. Kanouse, of Los Angeles, Calif. "Truplastic" is mixed with water and possesses physical working properties similar to both plaster of Paris and modeling compound, being in between the two and possessing to a great degree the advantages of both. Postdamming, where indicated, may be done either before or after applying the "truplastic." Soap suds (use laundry soap) is used as a separating medium.

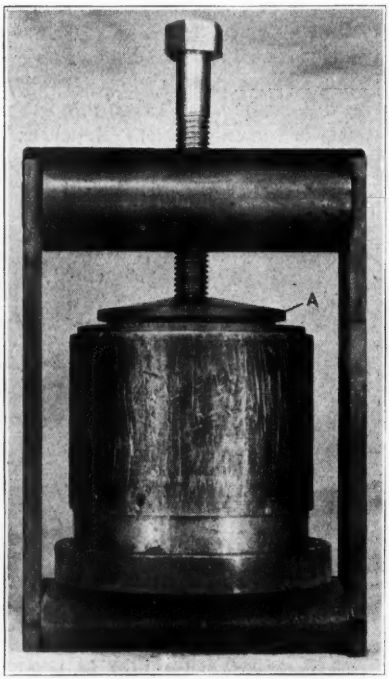


Fig. 30.—Various parts of the duplicating flask assembled and in position in the flask clamp and screw pressure applied, adapting the paraffin to the cast under pressure.

CASTS

Plaster of Paris is used for casts and the method of mixing plaster, as suggested by P. M. Orlopp, technician at the Chicago College of Dental Surgery, is recommended. Mr. Orlopp contributes the following:

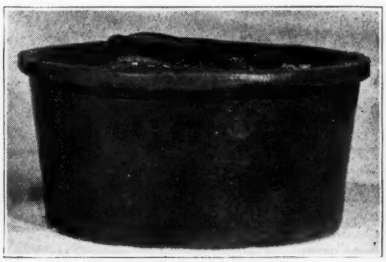


Fig. 31.—Finished paraffin mold ready to receive the cast material, from which a perfect duplicate cast will be delivered.

Follow a definite technic not only in the method of mixing but the amounts of plaster of Paris and water. Use measures, also *time* the mixing, always bearing in mind that at no stage of denture work is there a place where a poor mix is good enough just because it is to be used as a filler. For instance, in filling the flask for vulcanization, the plaster filling the flask is just as important as the cast, for if the cast does not receive the proper support a distorted case is the result.

The method of combining plaster and water has been simplified by the following technic so that a uniform mix is obtained at all times:

Obtain a piece of glass 5 by 5 inches (this is the bowl cover) and use (1) a standard bowl; (2) 2-ounce wide mouth bottle; (3) 1 ounce of borax; (4) 1 gallon of distilled water, and (5) a standard tablespoon.

The borax is dissolved in part of the gallon of distilled water. This is accomplished better by *heating,* after which it is added to remainder of water. As plaster is affected by minerals contained in water, varying in different localities, it is advisable to use distilled water, thus insuring uniformity.

Place 6 level tablespoons of any normal plaster (meaning plaster having neither retarder nor hastener) in the bowl. The 2-ounce bottle is filled with the borax solution. The measured amount of solution is then poured over the plaster in the bowl, the glass cover is placed on bowl, and by grasping the bowl in such a manner that the thumbs hold glass in place, the index fingers to the front and the remaining fingers supporting the bottom of the bowl, the whole is shaken with a forward and down jerky motion for one full minute, the cover removed and 2 more level tablespoons of plaster is added, after which the cover is replaced and the agitation repeated for one-half minute. The cover is again removed and an additional 2 level tablespoons of plaster is added and again shaken for one-half minute. At this stage, with some plasters, the peak will have been reached. A creamy mass will be the result and will flow with the minimum amount of jarring into the smallest depression. Again, more can be added, but the foregoing procedure should be followed by adding 2 level tablespoons of plaster at a time and agitating for one-half minute for each addition, thus: 6 level tablespoonfuls of common plaster, and 2 ounces of borax solution (agitate for one minute); 2 additional level tablespoonfuls of plaster (agitate for one-half minute); 2 additional level tablespoonfuls of plaster (some plaster stops here) (agitate for one-half minute); 2 additional level tablespoonfuls of plaster (another may stop here) (agitate for one-half minute); 2 additional level tablespoonfuls of plaster (some will reach this point) (agitate for one-half minute).

By this method, the water or solution is held constant, never varied (other than to make a mix in multiple, say two times then double the formula, but the time of agitation is held the same). Thus, we can find the peak of any plaster by the simple method of adding plaster in the known quantity until the watery sound has given way to a more pronounced slopping sound. One or two trials will reveal the point. Borax in the quantity stated is an ideal retarder, having none of the bad after effects so common with the other salts. It exerts a beneficial effect and permits at least 50 per cent more plaster to be incorporated in a given amount of the solution than is possible with water alone. It is advisable always to make the solution in large quantities so it will be the same temperature as the plaster when needed.

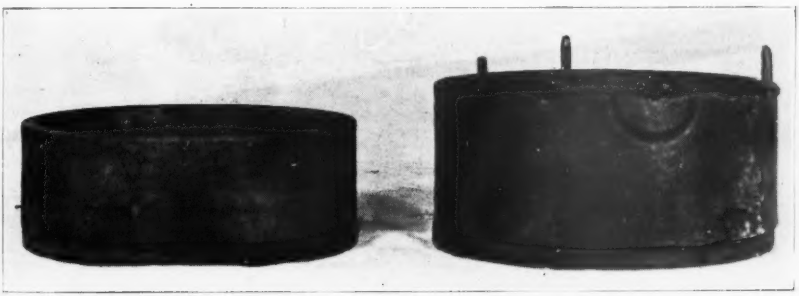


Fig. 32.—Combination swaging and vulcanizing flask.

By increasing the ratio of plaster to water as directed by Orlopp, much greater density is secured, and therefore the cast is much stronger.

DUPLICATING CASTS

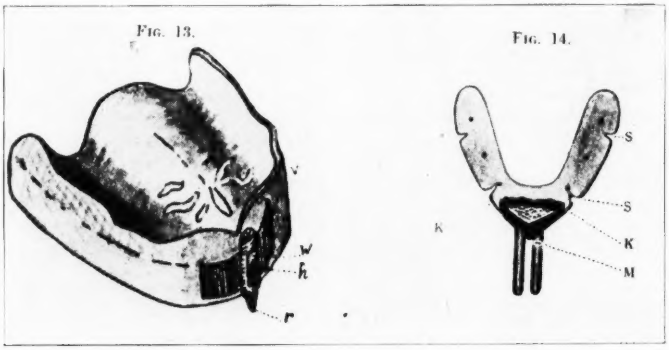
It not infrequently happens that a case is considered experimental or questionable in some way or other, that a record of the cast is desired or that duplicate dentures are to be made. In such cases, the taking of a new impression and all of the work incident thereto may be saved by duplicating the cast.

It took me many years to evolve an equipment and perfect a technic for the accurate duplication of a cast and I am happy to pass the process on for information and use. For years, duplicating casts has been a routine practice in my work in the handling of many of my cases.

Figure 24 shows the original (master) cast mounted in a ring. The ring is tapered so that the cast may be removed therefrom and preserved and the ring used for another case.

Fig. 25 shows another ring placed on the first ring and around the cast.

Fig. 26 shows another ring with a re-



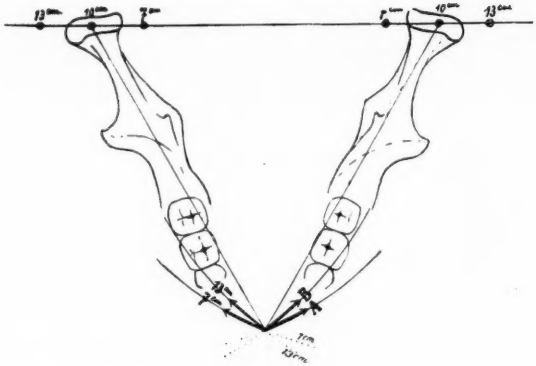


Fig. 33.—Gysi's path marker and gothic arch tracing.

cess forming a seat which telescopes and rests upon the first two rings, shown in Figure 25.

With the cast and rings oiled, melted paraffin is poured into the cavity formed by the latter ring, filling it to the top (Fig. 27). On cooling, the rings are separated and the paraffin block or mold (Fig. 28) is produced. The large ring (Fig. 26) is tapered also, permitting easy removal of the paraffin mold.

The small ring (Figs. 25 and 28) is for the purpose of providing excess paraffin for compressing the paraffin about the cast and is next removed from around the paraffin (Fig. 29).

With the paraffin block slightly surface warmed and the flask and cast oiled, all is assembled, and placed in position in the flask clamp and brought together with screw pressure (Fig. 30), the paraffin conforming to the cast under pressure.

The clamp and flask are placed in cold water, and as the paraffin cools, the screw is progressively tightened, which takes up the shrinkage of the paraffin as it cools and insures perfect adaptation to the cast. Whereupon, the flask is separated and the finished paraffin mold (Fig. 31) is delivered, from which a perfect duplicate cast is secured.

In cases presenting undercuts, the paraffin is carved away, releasing the undercut, and oiled, and a separate piece of paraffin is adapted, forming a core.

A perfect duplication is easily and quickly made in any case with this process.

Placement of a blank ring in the flask in the position occupied by the ring carrying the cast, with the paraffin mold in place and poured with artificial stone, delivers a duplicate stone cast mounted in the ring all in one mix, exactly like the master cast (Fig. 24) for swaging metal bases, which may become a part of a vulcanite flask, permitting final swaging before closure of the flask after packing before going to the vulcanizer. Such a flask is shown in Figure 32, which I always employ when using a swaged metal base. No matter how carefully I handle a swaged base in securing centric relation and setting the teeth, I find that it gets out of shape, and that a final swaging, leaving the base on the cast, undisturbed, at the time of packing and vulcanizing, is the only way to insure adaptation. The ring forming the base or cast half of the flask goes in the swager, of course. This

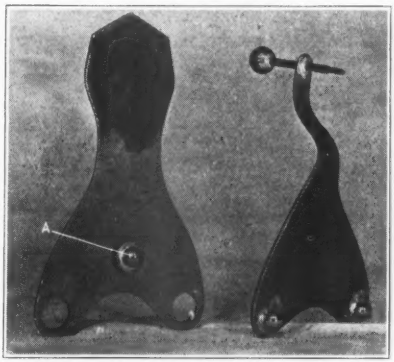


Fig. 34.—Hall's equipment (bite-plates) for securing centric relation (bite).

has been a strong point with me for a long time. This method of reproducing casts and swaging metal bases is more accurate and more simple than any yet devised. Metal dies are not so accurate, are far more difficult to make and often contaminate the metal used in the baseplate.

BASEPLATES

"Trubase," Grafs, or "ideal" baseplates are used in difficult cases requiring numerous try-ins, and ordinary baseplate wax is used in easy cases. The latter saves time and is easier and less troublesome to handle.

CENTRIC RELATION OF THE MANDIBLE TO THE MAXILLA

Centric relation of the mandible, popularly termed the "bite," as believed and accepted to be scientifically and accurately established in all cases by the gothic arch tracing with the path marker, after Gysi (Fig. 33), has been found, in some cases, to be an arbitrary relation and not the centric relation in which the case functions.

FUNCTIONAL CENTRIC RELATION

Functional centric relation we define as that relation of the mandible to the maxilla about which the mandible functions as a center in mastication. This center has been found to be different in some cases from that indicated by the gothic arch tracing after Gysi, and assumed to be functional. Failure to recognize this fact and to restore occlusion according to the functional centric relation accounted for trouble with the occlusion in at least one of my full denture restorations.

I discovered this condition and met its requirements in connection with two cases under treatment at the same time. Each patient was wearing a full set of dentures, one made by me two years previously, and both cases were functioning in protrusion to the centric relation of the dentures, which indicated that functional centric relation was missed in their construction. Attempt to make new restorations for these patients, using the centric relation determined by the gothic arch tracing, failed to correct the difficulty, each case functioning in protrusion as with the old dentures. Description of the equipment and technic used in the successful treatment of these cases, and now employed in all cases, as a checkup, follows:

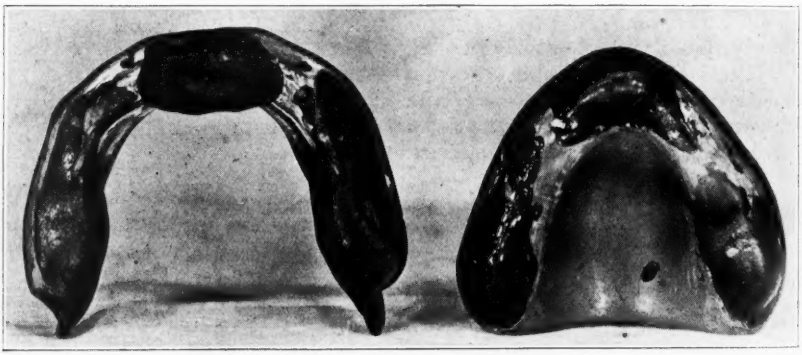


Fig. 35.—Baseplates with wax mounted thereon ready to receive the bite-plates.

Two brass plates, one with an extension carrying a stylus (path marker), and one with an extension which carries black wax for recording the gothic arch tracing (Fig. 34) are adjusted and secured to the upper and lower baseplates with hard wax or compound (Figs. 35 and 36).

The ball mounted on screw *A* carried by the lower plate (Fig. 34) makes contact with the surface of the upper plate (Phillips' principle) and establishes the estimated or correct intermaxillary space by the necessary adjustment of the screw.

Some believe it desirable or necessary to have the central bearing contact point

(ball) function on a curved plate with a radius of 4 inches instead of on a flat plate. This is not necessary because the distance of travel of the point on the plate in registering functional relations of the mandible is not sufficient to record any measurable difference in the direction or the character of the movement, whether it be made upon a plane or upon a curved surface. The point in question is purely one of theory and is not one of any practical importance whatsoever.

Centric relation *B* (Fig. 36) having been determined by means of the path marker, the patient is next instructed to make opening and closing movements, indicating the functional centric relation of the mandible *C* (Fig. 36), for example.

The functional centric relation (comfortable habitual relation) established by repeated opening and closing may or may not coincide with the relation determined by the gothic arch tracing. The stylus will show the difference, if any, between the two relations. If different, a dot *C*, for example, formed by the stylus, will indicate the functional center. If not different, the point *B* is both the centric and the functional centric relation. The correct or desired relation being settled on, three points of contact between the upper and lower plates, fixing them in the desired relation, are next established by adding two soft balls of modeling compound *D D*, to the lower plate (Fig. 36), and having the patient close the mandible, bringing the ball into contact with the upper plate. The compound forms about the two stabilizing key balls, *C C*, carried by the upper plate (Fig. 36) and the relation desired, verified by the stylus, is thus fixed and the case is ready for mounting in the articulator (Fig. 37). Dropping a little soft wax into the holes in the compound, after cooling, and repeating the closing process, reseating the two key balls, will compensate for any discrepancy resulting from shrinkage of the compound on cooling.

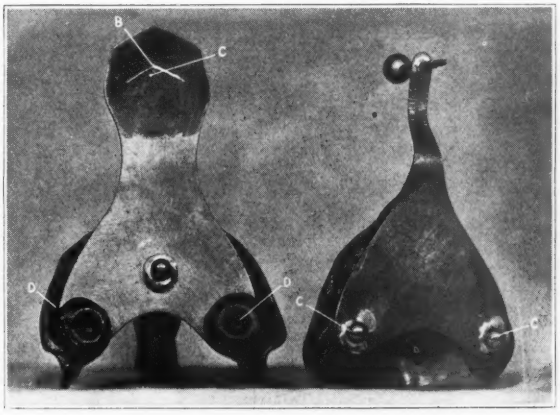


Fig. 36.—Bite-plates mounted on baseplates. This figure also shows the gothic arch *B* and the functional centric relation *C*, as developed by the patient and recorded with the path marker. *D D* and *C C* show means by which the centric or functional centric relation of the mandible (bite) is fixed for mounting the casts in the articulator.

Several minutes should be consumed in the opening and closing process so that the patient will be sure to register the true functional centric relation. Closure in functional centric relation is certain to follow because of fatigue.

New baseplates should be made for setting the teeth and the bite registering equipment preserved for future use in case it is necessary to take a new bite because of changing the bite in the articulator, which is explained later. Adjustment of the screw *A* will adapt the equipment to any changed relation.

the very thing that we do not want. This relation may be the cause of failure in some of our cases because we have forced the patient to give us this unnatural relation and in turn imposed dentures on them constructed to this relation rather than to their normal functional relation, which they would give us if permitted.

This condition, if present, creates additional difficulty in the registering of mandibular relations for the use of adjustable articulators and cusp teeth because cases the functional centric relation of which do not agree with the

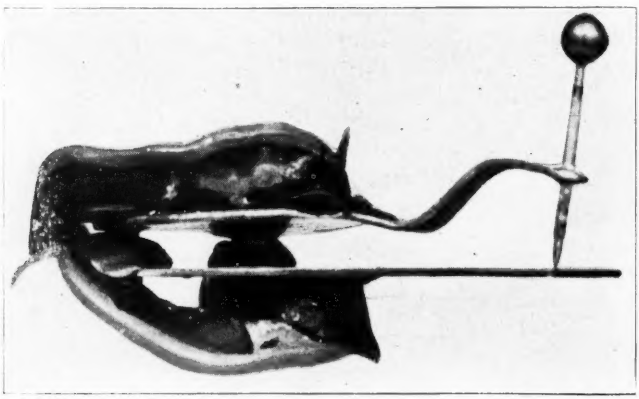


Fig. 37.—Means described in Figure 26 holding the baseplates in the relation established in the mouth.

The relation established by the opening and closing process is normal and habitual to the individual establishing it, and is the relation to which the occlusion should be constructed in place of the relation determined by the gothic arch tracing in cases in which the tracing is found not to coincide with the functional relation.

The centric relation determined with the gothic arch tracing, which we have been so insistent in demanding and which we have believed to be infallible, may be

gothic arch tracing furnish no bases from or by which to make registrations as does the gothic tracing employed in the Stansbery checkbite technic. It is but another complication added to this already too difficult and impracticable system.

MOUNTING THE CASE IN THE ARTICULATOR

Figure 38 shows the case mounted in a plane line articulator, the much discussed adjustable articulator being entirely eliminated in all cases. This

articulator provides means for varying the hinge axis as may be required when changing the bite. This saves detaching and reattaching one of the casts.

In order to change the hinge axis, the two hinge bearings *A A* are removed and turned around and their hollow ends *B* filled with plaster, and, with the casts seated securely in the baseplates, holding the new bite relation, they are screwed to place, forming a plaster bearing at either end of the hinge bar.

Figure 21 shows a plane line articulator which has been modified by the addition of mechanism for the readjustment of the hinge axis.

Loosening set screw *A* permits the required adjustment, and tightening the screw fixes and secures the new relation.

Figure 39 shows another plane line articulator providing means for changing the hinge axis.

Axis bar *A* is used for establishing the fixed axis and for the original mounting of the case. If the bite is changed, the bar is removed and tube *B* is adjusted in its place. The tube carries soft modeling compound and the screws are run in, imbedding their ends in the compound, which, when chilled, forms a hinge joint or axis for the new centric registration; a good scheme if it is kept away from high temperature, but not safe because of this reservation. Plaster is dependable.

Any change of centric relation (bite) in the articulator should be checked by taking a new bite in the mouth, using the bite equipment as in the first instance,

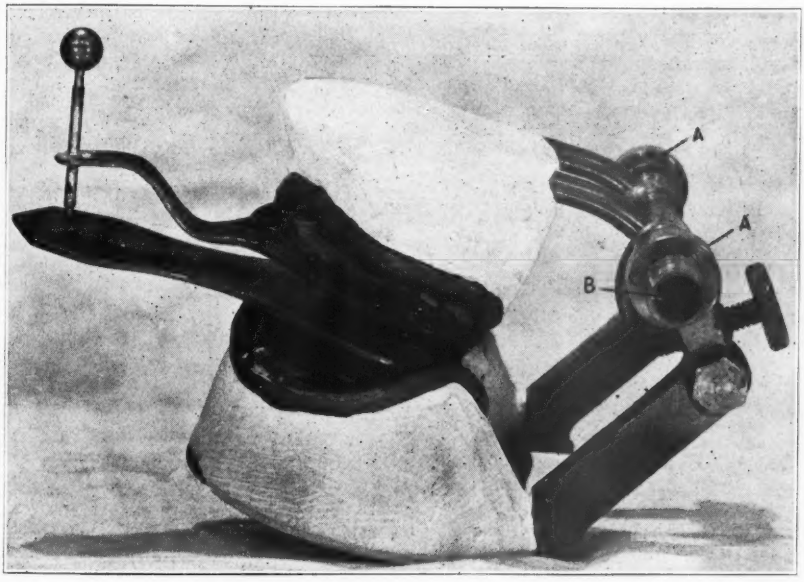


Fig. 38.—Casts mounted in a plane line articulator according to the relation (bite) shown in Figure 37. This also shows means for changing the opening axis of the articulator when changing the bite.

and remounting the casts accordingly or by changing the axis of the articulator. This is an absolute requirement if we are to have accuracy in our occlusion and prevent excessive grinding of the teeth.

This point explains why George H. Henderson made the statement at the meeting of the Chicago Dental Society in 1927 that the bite of every set of teeth that he ever had ground in an articulator had been ruined, and also accounts for my reason for taking his mandibular registrations and adjusting the three-dimensional articulator to a closed relation that anticipated and allowed for the amount of closure necessary in grinding his case in my clinic at the same meeting, previously mentioned. I demonstrated that this was the way to grind in a set of dentures so as not to ruin the bite, as correctly stated by Dr. Henderson is done, when grinding away from instead of to the centric relation.

Following the practice of taking a new bite in the mouth every time the bite is changed in the articulator and changing the axis in the articulator to coincide therewith, one will be astounded at the difference between bites and will appreciate as never before the importance of taking a new bite every time the bite is changed. This is an iron clad rule in my practice and has been so for many years. It must become so in the practice of every one, if he is to avoid the occurrence of unwarranted discrepancies in the occlusion of his cases. There has never been an articulator that opens and closes like the jaw itself. And, in this connection, and for this reason alone, if for no other, a truly anatomic articulator has not yet been demonstrated (facebow contraindication).

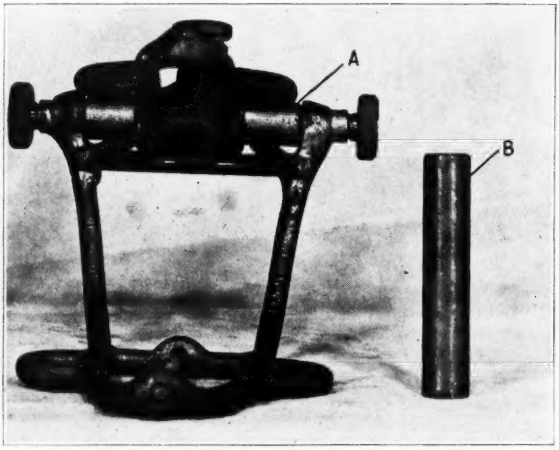


Fig. 39.—Another means for changing the axis of the opening and closing movement of the articulator.

As pointed out, the adjustments for centric relation in the three-dimensional articulator (Fig. 15) are new, and they are also new in connection with the plane line articulator as well. It is an important improvement in articulator construction. I have built five plane line articula-

tors, trying to perfect a satisfactory design embodying means for changing the location of the axis of the hinge quickly and easily.

SETTING UP THE INVERTED CUSP TEETH

The inverted cusp teeth, both upper and lower, including the anterior teeth, are set in conformity with the Ekloform template (Fig. 40) originally designed by H. B. Washburn, of St. Paul, Minn. Any form or make of anterior teeth desired is used with the inverted cusp teeth.

Both the theoretical conception and the practical application of the inverted cusp teeth are demonstrated by placing two Ekloform templates in apposition

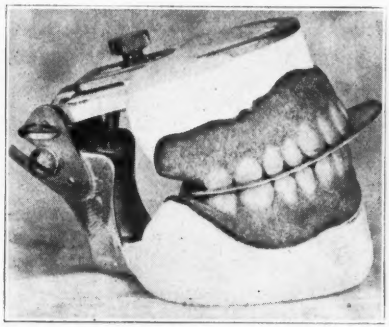


Fig. 40.—Inverted cusp teeth, both upper and lower, including the anterior teeth, conforming to the Ekloform template.

and moving the surface of one upon the surface of the other (Fig. 41). So related and moved, they represent the function of a set of inverted cusp teeth, including the anterior teeth.

Mr. Eklof states that the radius of the template is 5 inches. I believe that this radius is too short and that a greater radius will prove to be better.

There is but one precaution to observe in setting the inverted cusp teeth and that is with regard to overjet to prevent cheek biting.

A liberal overjet (overhang) (Fig. 42) of the upper teeth over the lower is indicated to guard the cheek tissues against being bitten. A flush or nearly flush relation, as with any other teeth, is likely to cause cheek biting.

CROSSBITE CASES

When it becomes necessary to cross the bite, the lower teeth are set outside the upper (Fig. 43) (prognathic [protrusive lower jaw] cases or large lower and small upper cases). The inverted cusp teeth work as well as when set in regular arrangement. This dispenses with the necessity of having special teeth for these cases. Orthognathic (retrusive

Fig. 41.—Two Ekloform templates, one superimposed upon the other, demonstrating the theoretical conception and practical application of the inverted cusp teeth.

lower jaw) cases are easily and efficiently restored with inverted cusp teeth. Such cases are, as with cusp teeth, best restored by omitting the lower second bicuspids and spacing the lower anterior teeth, reducing the spacings somewhat by using larger anterior teeth than regularly go with the upper anterior teeth being used (Fig. 51). The lower teeth are thus arranged with regard to leverage (placed over the ridge) and insure greater stability of the denture. Leaving out the second biscupids and setting the teeth

according to the ridges in such cases produces an arrangement presenting an extreme overjet (forward relation of the upper anterior teeth or distal relation of the lower anterior teeth) (Fig. 51) which, in most cases, is normal to this type of case and which, in all cases, will prove the most efficient arrangement for such cases.

Final try-in of the teeth being accepted, they are ready for waxing, flashing, vulcanizing and finishing.

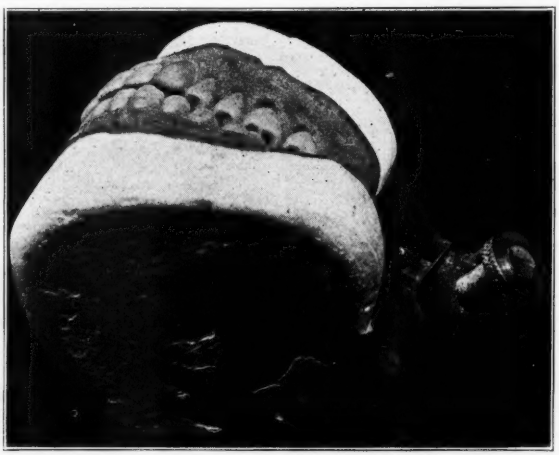


Fig. 42.—Liberal overjet of the inverted cusp teeth to prevent cheek biting.

The dentures on being finished are placed in the mouth and the occlusion is tested with carbon paper and ground where grinding is indicated, after which the patient chews carborundum, modifying the arbitrary basic curve established with the template to one of his own individual creation and requirement. Incidentally, centric and eccentric occlusions are likewise established in the most nearly perfect manner possible. The amount of grinding required to modify the arbitrary curve to the individual curve will in no case impair the efficiency of the teeth. In fact, it improves them. The sharp edges of the peripheries of the cups are cut away and small tables are formed which mash and triturate the food. We would grind in the occlusion for this reason, regardless of the curve.

Some anxiety exists as to whether or not the inverted cusp teeth pack with food. The cups do not pack with food nor retain food more than teeth of anatomic form because the cups have a fused, glazed surface and the process of mastication forces the food in and out of the cups. On completion of a meal, rinsing with water, as in natural teeth, cleanses and frees them of food particles.

There has not been a single case come under my observation, or that I have heard of, in which packing of food or retention of food has been reported except in one instance, and, in this case, a regular cusp tooth restoration worn by the same patient presents the same condition always because of indifference and failure apparently to make even an attempt to rinse the mouth and free it of food.

Cleanliness, then, is a matter that is entirely up to the patient. Even if the dentures have to be removed from the mouth and cleaned with a brush, which should be done anyway, regardless of the form of tooth, no objection can be made to such a requirement, as no less is required in the care of the natural teeth.

Fig. 43.—Inverted cusp teeth arranged in cross-bite relation (lower posterior teeth set outside the upper teeth) as required in prognathic cases and in cases with large lower jaws and small upper jaws.

Another question that is giving some concern is the matter of balance, there being no cusps with which to effect balanced occlusion as with cusp teeth.

Balanced occlusion is another phase of denture work that I have never been able to accept and enthuse over as have many of the members of the profession. It has never been proved to my satisfaction that balanced occlusion makes for any greater efficiency or permanency in dentures than do good plain occluded teeth arranged in the ordinary way.

Loomis P. Haskell, of Chicago, wrote as follows:[2]

> Much attention is being given to the subject of articulation, and many elaborate and well-illustrated articles have been written on the subject. Special attention has been given to the movements of the lower jaw—along what line it moves—and to the movements of the condyle, etc. These are all very well as illustrating, among others, the wonderful things pertaining to the human teeth, to which I have sometimes called attention in the journals, but as pertaining to the usefulness of artificial dentures they have but little bearing.
>
> My attention was recently called to an elaborate and carefully illustrated article by a prominent writer, in which he demonstrated the articulation of the artificial teeth precisely the same as the natural teeth, ignoring the fact that the human teeth are fixed in the jaws, while the artificial teeth are on movable plates, resting often on flexible ridges and

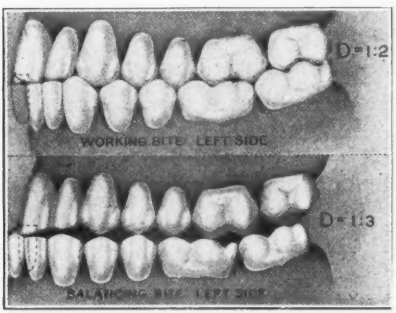


Fig. 44.—Typical so-called three point contact or balanced occlusion (Bonwill).

2. Haskell, L. P.: Fallacies of Articulation, Dent. Cosmos, 58:527 (May) 1915.

very often on ridgeless lower jaws, where the plate cannot extend below the lingual margin. Furthermore, the process is being absorbed to a greater or less extent, especially when vulcanite plates are worn in the upper jaw, the result of which is constantly shortening the bite, and thus changing the position of the jaws.

These conditions cannot be overlooked, as they have much to do with the usefulness of the dentures in mastication. In the article referred to pains are taken to show that the anterior lower teeth must have the incisal margins beveled, as the author says that the natural teeth show that they have been in contact with the upper incisors, sliding along under them.

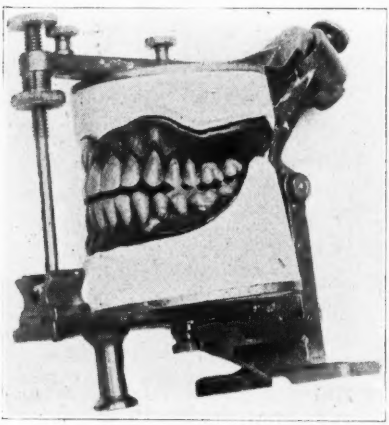


Fig. 45.—Balancing side of two point contact balanced occlusion (Hall).

Now consider what results. Perhaps under favorable conditions the contact is all right at first, but sooner or later any contact would displace the upper plate, and the trouble would become worse and worse, the patient thinking it was a misfit, because every time he would swallow during the day the jaws would close, and the plate be thrown down, until at last he must go to the dentist for a new set; and too often, as I have known the dentist does not realize the trouble, which he could easily have remedied by shortening the anterior or resetting the posterior teeth.

The fact is, the six anterior teeth should never under any condition come in contact. Not only that, but a leeway should be allowed for further shortening of the ridge. Having had twelve years' personal experience with a flat lower jaw, and also many years' experience with a full upper denture, I have learned things in regard to mastication which I never could have learned from other mouths.

Any dentist who has not had a similar experience has no idea what a patient has to contend with in learning to use a lower denture on a flat or nearly flat ridge; for he cannot look into the mouth and witness what is going on there, particularly in the movement of the jaw, tongue, and lower lip.

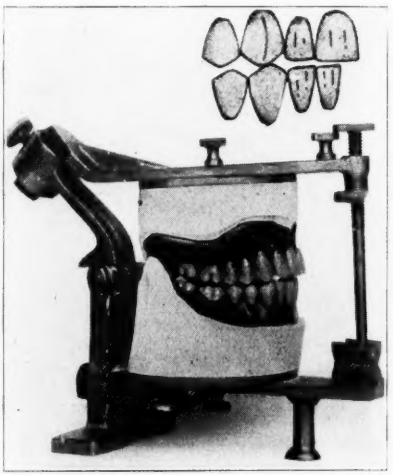


Fig. 46.—Working side of two point contact balanced occlusion (Hall).

The reason the patient cannot properly masticate tough meat or any other tough substance is because he needs the grinding process, and this, except in favorable conditions, is impossible, for mastication is simply an up-and-down process. The much-mooted "three-point" contact is of no practical value, therefore, as is to be seen, under these conditions.

Seventy years' experience devoted exclusively to the construction of artificial dentures; the use, for more than fifty years, of partial dentures, upper and lower, and full dentures; twelve years' experience with that

problem of the mouth, the "flat lower jaw," and the experience of knowing—as the dentist alone can know in his own mouth with the artificial denture—such an experience, it would seem, should enable the dentist to acquire knowledge that could be gained in no other manner. To me it has been a valuable experience. A well-known dentist and writer said he was "in favor of anatomical articulation provided the teeth were copper-riveted to the jaws."

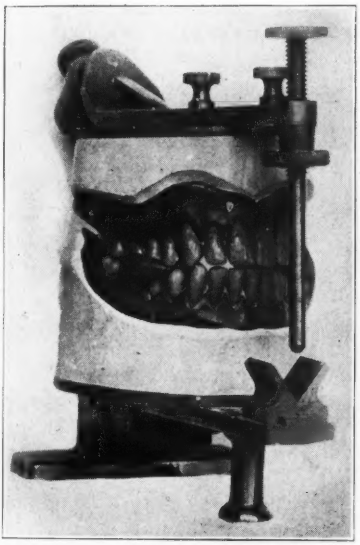


Fig. 47.—Bolus of food between the teeth on the working side, which demonstrates the practicability of two point contact balanced occlusion.

It is observed that Dr. Haskell said the very same things that I have pointed out in this paper, and, bear in mind, he was a wearer of dentures as well as a student, practitioner and teacher of this subject for seventy-five years.

George H. Henderson, also a dentist and wearer of full dentures, makes the same statements after having, so he states, more than fifty sets of dentures made for his case by himself and different dentists according to all of the so-called scientific methods for balancing dentures. Many of these cases were so poor that they were unwearable for comparison, he states.

Figure 44 illustrates typical so-called three point contact or balanced occlusion, which for years I have pointed out was not accomplishing the purpose for which it was designed, namely, providing space for food with contacting points between the teeth supporting the dentures against

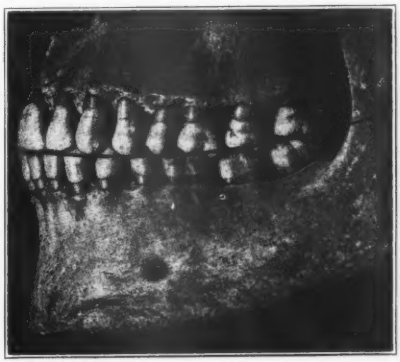


Fig. 48.—Curve of Spee.

dislodgment. The mere insertion of so small a thing as a pin between the teeth on the working side separates the teeth completely on both the working and the balancing sides, destroying the balance, making it valueless as a supporting or stabilizing means against dislodgment of the dentures. This scheme of occlusion is only effective with the teeth occluded without food between them. Many members of the profession besides Dr. Haskell, and even some of the laity, have pointed out this fact and questioned the actual value of balanced occlusion. I am surprised now that we have gone on so long and so far as we have with the study and practice of balanced occlusion.

As a student, and for many years as a practitioner, the term balanced occlusion mystified and disturbed me because I did not understand it. I thought it would do great things for my patients and be of great value to my peace of mind if I could but understand and master this thing they called balanced occlusion. I now believe that I understand it and that I have mastered it, but, beyond meaning smooth, easy gliding occlusion, I do not believe the term has any significance. In other words, it does not stabilize the dentures with food between the teeth—the thing I always understood was its primary object

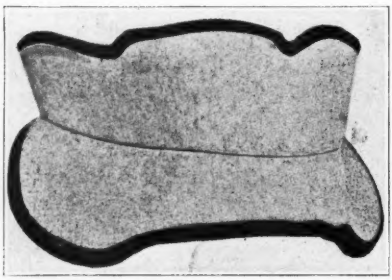


Fig. 49.—Curve of Spee established by the patient chewing upon occlusion rims made of equal parts plaster of Paris and carborundum.

and function and believe to be the understanding of almost every one.

Hahn, in the *Correspondenzblatt für Zahnärzte,* October, 1907, called attention to the fact that "Spee's curve and the molar cusps are of no value at the moment the food is first seized by the teeth, as the dentures are not yet closed, and for this reason the teeth must be so placed that they will balance the dentures in the very beginning of the masticatory act."

In 1915, I introduced a scheme of occlusion which I called two-point contact.

The purpose of the two-point contact plan of occlusion was to provide space for food with points of contact to stabilize the dentures, one point of contact on the balancing side between the second molars, as in three point contact arrangement, (Fig. 45) and one point of contact between the cuspids on the working side (Fig. 46). Figure 47 shows a bolus of food between the teeth on the working side, which demonstrates the practicability of the two balancing and stabilizing contact points.

Today, I do not believe in this or any other form of balanced occlusion.

If it is best to remove the cusps from teeth for edentulous restorations, it is also best to free them of balancing contacts, because they are identical in effect —an interference against free horizontal movements as permitted with plane line occluded inverted cusp teeth.

There is but one thing that has been proved to be fundamentally basic and anatomic in this whole question of movements of the mandible, adjustable articulators, etc., with regard to balance, and that is the so-called basic curve (curve of Spee) outlined by the teeth that we observe in nature. (Fig. 48.) Nature presents these curves in all cases, while balance as we make it in artificial dentures is not found in natural teeth as an anatomic characteristic. Nature will reestablish these curves if given an opportunity in any case, by chewing in the curve as originally demonstrated by Prof. Carl Christensen, of Copenhagen (*Dental Cosmos,* October, 1905).

In my clinic at the meeting of the American Dental Association in Rochester, N. Y., in 1914, I demonstrated the chewing in of the basic curve by the patient (Fig. 49), and the close adherence to this curve in the arranging of the teeth, seeing that the cusps of each tooth and the incisal edges of the anterior teeth

of both the upper and the lower teeth conformed to the surfaces of the curve as established by the patient. The preliminary curve was arbitrarily formed and located with occlusion rims made of equal parts plaster of Paris and carborundum. The esthetics and the ridges were the factors determining the vertical location and radius of the curve. Having the patient chew in this curve is practiced and advocated by some today. It is a highly scientific and practical procedure but wholly unnecessary in the method of denture construction described in connection with the use of inverted cusp teeth.

If we will make of the surfaces of these chewed-in curves a grinding, masticating machine, I believe that we will not only be permitting nature to create her own anatomic restoration, but will also be restoring the function of mastication in the most simple, efficient and permanent manner.

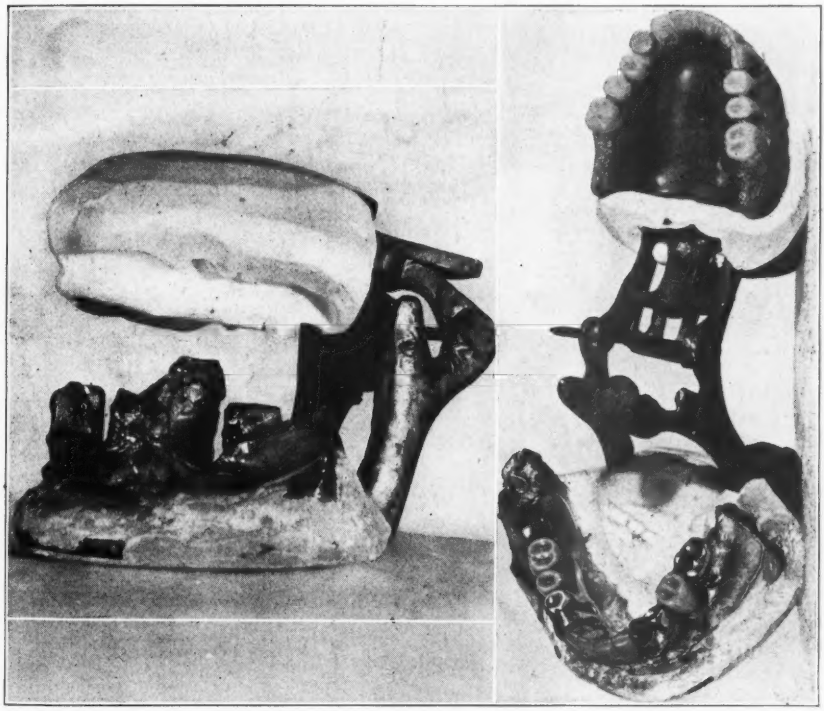


Fig. 50.—Case with an edentulous upper and partially edentulous lower jaw with the two cuspids, first bicuspids and left second molar remaining. These teeth were worn down and extremely sensitive. This case was restored with inverted cusp teeth.

Employment of the technic outlined and the use of inverted cusp teeth produces restorations that fulfil the require-

ments of this conception. With the use of this technic and these teeth, I am making my first dentures that I know to be absolutely and unquestionably anatomic. My patients are satisfied and are even enthusiastic, praising the merits of these teeth over the cusp teeth. They sense and

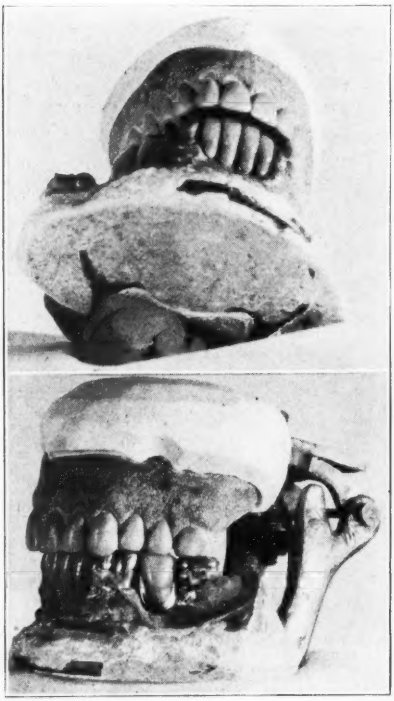


Fig. 51.—Case shown in Figure 50 restored with a removable inverted cusp tooth restoration, the natural teeth being restored with gold inverted cusp castings, which are a part of and are removable with the fixture.

comment on the absence of tipping and rocking of the denture experienced with and occasioned by the contacting points of the cusps and balancing points in the use of cusp teeth, balanced or otherwise. The freedom they enjoy with these teeth—moving the mandible in any direction without cusp and balance interference—gives them a sense of comfort not enjoyed with so-called cusp teeth and balanced occlusion. They also state that these teeth are very much more efficient.

TISSUE TRAUMA AND SORENESS RESULTING FROM CUSP AND BALANCE INTERFERENCE ALMOST ENTIRELY ELIMINATED WITH THE USE OF THE INVERTED CUSP TEETH

With the use of inverted cusp teeth, tissue soreness resulting from trauma is reduced to a greater extent than I ever realized or believed occurred as the result of movement of the denture bases because of cusp and balance interference. Tissue soreness is reduced tremendously. In one cusp tooth balanced case in particular, as an example, the patient had suffered with soreness during the entire time (five years) the case (several cases, in fact, during this time), was worn but has not had a single point of irritation or soreness since the insertion and use of an inverted cusp tooth restoration. Numbers of similar cases and experiences have been observed and reported. Indeed such comparative results are nothing short of a revelation in denture construction.

Another practical and unanswerable demonstration that cusp teeth are not indicated is found in the fact that it is rare to see such teeth doing good service and giving the patient comfort for any length of time after insertion; whereas, many sets that were made thirty or forty years ago without an attempt to reproduce natural cusp formation and occlusion, in fact with cusps almost missing or ground away, are still giving service and have remained comfortable to the patient during all that time. It is here predicted that the inverted cusp teeth will give a similar service.

This scheme of occlusion eliminates all of the work and trouble present and future, such as registering mandibular relations, adjusting articulators, regrinding and rebasing, incident to the use of interlocking cusp teeth, and permits the jaw and denture relations to change without producing malocclusion. Whereever the jaw moves and occludes, the inverted cusp teeth are in comfortable and efficient full occlusion. The only discrepancy that can arise as the result of the change of relation of the dentures to one another is an uneven coming together of the teeth in the various occlusions which may be readily corrected with the stone or by the patient chewing carborundum as in perfecting these relations in the beginning. In some cases with good jaws, wear of the teeth will progress simultaneously and automatically with any change of relation occurring between the dentures and thereby keep the occlusion of the dentures in adjustment.

The cutting edges and grinding surfaces of the inverted cusp teeth never become dull and inefficient as with cusp teeth. The margins of the cusps maintain sharp, cutting edges as they are ground down or wear away.

The lessening of the number of steps and time consumed in the use of the inverted cusp teeth recommends them to both dentist and patient alike. It is believed that their introduction will put this phase of dentistry on a practical and economical basis.

Partial denture and crown and bridge cases permitting use of inverted cusp teeth are also best restored with this form of tooth.

Figure 50 shows a case with an edentulous upper and partially edentulous lower jaw with the two cuspids, first bicuspids and left second molar remaining. These teeth were worn down and extremely sensitive.

Figure 51 shows the case restored with a removable inverted cusp tooth restoration, the natural teeth being restored with gold inverted cusp castings, which are a part of and are removable with the fixture.

I previously made two cusp tooth restorations for this patient and in neither case was I able, because of jaw and ridge relations, to restore masticating efficiency, ending in both instances by grinding off the cusps of the teeth until they were flat. The use of the inverted cusp tooth made possible a successful, efficient masticating restoration.

Full upper or lower restorations of inverted cusp teeth may be made against opposing natural teeth if the natural teeth are worn flat or nearly flat.

In this paper, one is directed in the making of the best of the old form of dentures (balanced cusp teeth dentures, in which I have made clear I do not believe) and in the new form of dentures (plane line occluded inverted cusp teeth) in the most scientific, complete, and practical manner. I believe either system to be treated the best in their respective class and that the work here presented will stand the test of time. If a fully adjustable articulator has a place in dental practice and must be used, the three-dimensional instrument fulfils every requirement and will be the instrument of the future.

I am frequently asked, "What do you think of the Sears channel tooth?" My answer is, "The aim of these teeth is to free dentures of cusp lock and interference in the anteroposterior relations and movements and to anticipate and compensate for anteroposterior relational change between the dentures as a result of settlement of the dentures. This point

is well taken, and I accept the principle as being desirable and practicable. But the channel tooth is still a cusp tooth. What are we going to do about cusp lock and interference in the lateral relations?"

The same identical reasons and arguments for freeing the teeth of cusp lock in the anteroposterior relations are applicable to freeing the teeth of cusp lock in the lateral relations, and for the very same reason Sears freed the teeth of cusps in the anteroposterior relation, I freed them of cusps in the lateral relations; which carries the principle of freeing dentures of cusp interference to a final, complete and practical conclusion.

Any one believing in and accepting the principle of the Sears channel tooth will, of necessity, for the same reasons, be forced to believe in and accept the principle of the inverted cusp tooth.

The use of the channel tooth still requires the adjustable articulator with all of its accompanying complicated and impracticable drawbacks, already discussed and relegated to the attic or museum.

It has been my intention to give credit where credit is due in this article and I trust I have not failed to do so in any instance. I am deeply grateful for the benefits I have derived from my association with the members of the National Society of Denture Prosthetists and to others with whom I have worked and counseled. Without their association and counsel, many of the points discussed in this work might have escaped my attention and consideration.

Every semblance of the complicated, mystifying, impracticable, trouble making and disappointing methods dealing with registration of the movements of the mandible and adjustable articulators, used in the so-called anatomic methods of constructing balanced dentures, has been removed from the method and technic for making dentures recommended in this paper. In my article to follow, I will show conditions heretofore undiscovered in connection with mandibular movements and articulators that add even greater complication to the practice of these principles.

SUMMARY

The points in this paper for making dentures according to the methods recommended may be briefly summarized as follows:

1. The individual modeling compound tray and "truplastic" makes the best all-around impression.
2. Plaster of Paris is used for casts.
3. The high fusing composition baseplates, such as Grafs, ideal baseplate or trubase are used for baseplates in difficult cases and ordinary baseplate wax is used for easy cases.
4. Functional centric relation of the mandible to the maxilla (bite) is scientifically and practically determined by a combination bite equipment embodying the ideas of Phillips, Gysi and Hall.
5. A plane line articulator is used.
6. The teeth are plane line occluded according to a template.
7. Occlusions of the dentures are made absolutely anatomic by finishing them directly in the mouth according to the individual requirements of the case by having the patient chew carborundum, making an articulator of the jaws themselves that are to wear the denture—the only truly anatomic articulator at our command.

DENTAL EDUCATION IN THE UNITED STATES*

By RALPH R. BYRNES,† D.D.S., F.A.C.D., Atlanta, Ga.

THE subject, "Dental Education in the United States," probably will convey to most minds institutional education along dental lines. While it is, of course, generally understood that education of any sort commences only on the completion of a prescribed course of study, I shall place the usual construction on the term "education," and shall endeavor to restrict my remarks as far as possible, to dental education in the dental schools of the United States of America. In doing so, I do not wish to obscure the fact that a great deal of dental educational progress occurs in dental society meetings and like assemblages, where original methods are brought out. But, in the main, the progress that dentistry has made in the United States in the past can be attributed to the dental schools and the methods taught therein. Likewise, most weaknesses that have been manifest in dental practice can be traced to the same source.

Just here it may not be amiss to recall briefly the early history of dentistry in the United States, in order that we may view dental progress in the light of time and opportunity.

A hundred years ago, in this country, dentistry was considered a mechanical trade. At that time the technic of dentistry was acquired by apprenticeship, there being no dental schools in the country. The art was then practiced by mechanics and the "more refined" blacksmiths. These heroic, rugged practitioners had, of course, a very low vision of the importance of their work.

The first dental college in the United States was established in Baltimore, Md., n the year 1839, under the name of "The Baltimore College of Dental Surgery." Prior to this, Chapin A. Harris, one of the principal founders of that dental college, first petitioned several of the medical schools to include dental courses in their curriculums. These offers were spurned by every medical college to which they were made, and the establishment of the Baltimore College of Dental Surgery as a separate teaching institution was effected as a last resort, only after all assistance and encouragement had been denied by the medical profession.

Although there were practically no preliminary educational requirements for entrance to the first dental college, and the courses offered were superficial, the mere fact that dentistry was beginning to be considered a science worthy of institutional instruction exerted a tremendous influence for good on the practice of dentistry. People began to consider it more than a mere trade, and each year thereafter dentistry grew in the estimation of the public, until today in the United States, among enlightened people, it is regarded as a branch of health service of paramount importance. It now

*Read before the Sixth Australian Dental Congress.

†Executive Dean, the Atlanta-Southern Dental College.

ranks with medicine and other great sciences devoted to the problems of physical welfare. This change of status in the public mind has been due primarily to the dental educational system in the United States.

Dentistry, in America, has elevated itself "by its own bootstraps." The dentists of America have fought a lone battle, and their progress is the result of their independent and unaided efforts. Incidentally, it may be claimed that that progress has been considerable, and has kept pace with dentistry's sister profession, medicine.

The first dental courses ranged from one to two years in length. Gradually, the educational requirements for entrance to dental colleges were increased from practically nothing to a grammar school education, then to one, two, three and four years of high school, and finally to one or more years of predental college work.

There are at present forty-three recognized dental schools in the United States, and approximately 60,000 graduate dentists. Dental schools in the United States are classified as A, B, and C by the Dental Educational Council of America. The highest rating, A, cannot be had unless the dental schools require for entrance at least one year of predental work in college.

Because of the discrepancies between the elementary education system in your country and in ours, it would seem necessary to review briefly for you the system in operation in America, in order that all predental requirements, of whatever nature, may be understood.

I quote from a recent bulletin entitled "Education in the United States of America," in which the commissioner of education, in referring to our free public school system, says:

The school systems provide, for every child capable of following it, a direct and open pathway for regular progress from the kindergarten to and through the university, regardless of the social or the financial status of his parents.

The first opportunity for education is in the kindergarten. It is offered in practically all the large cities and in many smaller communities, for children 4 to 6 years of age. In forty-four of the States, there are laws which permit or require the establishment of kindergartens. Although completion of the kindergarten unit is not a prerequisite for admission to the elementary schools in the majority of systems, there is a marked tendency to consider the work of the kindergarten and the first two or three grades as a unit. The term commonly used for this unit is kindergarten-primary grades. Nursery schools are becoming recognized as an asset in pre-school education. They care for both the physical and mental education of young children up to the age of four or five, when they enter kindergarten.

In those systems in which kindergartens are not established, children usually enter the first grade of the elementary school at the age of six. The number of elementary grades above the kindergarten varies in different parts of the country, and it may be six, seven or eight. The organization of the secondary school varies correspondingly, for the two classes of schools are interdependent. Children moving from one part of the country to another, or from grade to grade within any school system, make the transition without difficulty.

The elementary school of eight years, or grades (the two words are used synonymously), for children from 6 to 14 years of age, is by far the most common. It is followed by the secondary or high school of four years. The two together constitute what is generally called the 8-4 plan.

In the southern section of the United States a seven-year elementary school, followed by a four-year high school, is commonly found. It is known as the 7-4 plan.

There is an increasing tendency to adopt the 6-3-3 plan of organization consisting of six grades above the kindergarten, constituting elementary school, followed by a three-year junior high school, which, in turn, leads to a three-year high school, both the junior and the senior high school being considered in the field of secondary education. Completion of high school in any one of these plans is

marked by the granting of a diploma on graduation.

Graduation from a high school, or its equivalent, is essential to admission to classes leading to a degree in any of the various institutions which give instruction on the higher education level. In the colleges, normal schools and universities, the first four years of study are termed "undergraduate." The common practice is to speak of the first year as the freshman, the second as the sophomore, the third as the junior and the fourth as the senior year. On completion of the first four years of higher education work, the student receives the bachelor degree in arts, sciences, philosophy, pedagogy, etc., as the case may be. The degree is attained usually when the student is 22 or 23 years of age.

The four-year undergraduate school may be followed by study in the graduate school. The completion of one year of class study in residence with a written dissertation leads to the degree in arts, sciences, etc. Two years more of study, including research work and a dissertation, are required for the degree of doctor of philosophy.

The work of undergraduate college students is generally credited in semester hours, a semester hour's credit being one credit for a subject taken one period a week for one semester. (A semester is one-half of a college year of nine months, or four and one-half months.) Most subjects are offered three times a week, and, therefore, usually carry six semester credits a year. One hundred and twenty semester hours is the normal requirement for graduation.

The status of dental education in America today is unstable and uncertain. While it is generally agreed that the time has come when candidates for the dental degree shall possess a broader preliminary education than formerly, no plan of dental education has been adopted which meets with unvarying approval. As many as seven distinct plans have been evolved within the last few years, all of which have some staunch adherents. It would be a hard matter to determine which of these plans is favored most, but I believe I am right in thinking that the most popular one so far is that which requires a full high school course, plus one year of college predental work, embracing such subjects as English, chemistry, biology, zoology and physics, totaling thirty semester hours, or not less than six semester hours in each subject, followed by a four-year course in dentistry, each year to consist of eight months. This plan is in accordance with the standard set by the Dental Educational Council of America for all Class A institutions. It was officially adopted by that Council to take effect in 1926, and is now the minimum requirement in all Class A dental colleges.

Prior to 1926, the plan advocated by the Dental Educational Council of America stipulated that four years of high school work was sufficient for entrance to a dental college. These requirements are still in effect in some dental colleges in America, which are classified with the lower rating of B or C.

One plan contemplates one year of predental college work, plus four years of dental instruction, all of which is to be spent in the dental college. At the present time, this year of predental work is taken in a liberal arts college as a separate preparatory course, and, in that respect, the proposed plan differs from the one now in force in most Class A dental colleges.

There is still another popular plan, known as the two-three graduate plan, which embraces two years of preparatory university work and three years of instruction in a dental college.

Another plan considers two years of university preparatory work and four years of dental college work, totaling six years.

Yet another plan, which is in operation in some colleges and seems to be rather popular, requires a course of five years, with the second year of university work dovetailing into the first year of

the dental college course, enabling the student to obtain the bachelor of science degree as well as the D.D.S. degree.

Of all the plans offered, I am most enthusiastic over that one which I was the first to advocate, and which is now in operation in several of the larger dental colleges in the United States. This plan requires one year of predental college work plus three years of instruction in a dental college, each dental school year to consist of four quarters of twelve weeks each, or forty-eight weeks in each session. The chief reason for my approval of this plan is that such a plan would relieve an economic situation which is detrimental to the student as well as to the college. It is presumed that prospective students of dentistry, while ever alert to the profundity of their chosen mission in life, are nevertheless at least vaguely aware of the fact that they must make a living out of dentistry. Why, then, should they be compelled to spend but thirty-six out of fifty-two weeks in each year in the pursuit of learning? Why not four quarters of twelve weeks each, or forty-eight weeks in each session? This would make it possible to concentrate and accomplish in three sessions of forty-eight weeks each the equivalent of the present four sessions of thirty-six weeks each. Also, it would permit a minimum of two vacations of one month each, instead of three vacations of four months each, as is customary at the present time. The dental course would then consume three calendar years instead of four. There would be various other benefits to be derived from such a plan of training. It would make possible the employment of more and superior all-time instructors, and would thus indirectly better the discipline and raise the morale of both students and teachers. For those who would recoup their finances by longer vacations than one month, the introduction of quarters would permit taking out either three months or four months as they choose, summer or winter, for such vacations.

The lessening of the time required for the completion of a dental course without the lessening of teaching would, in the end, benefit the public, by reason of the fact that in proportion to the cost of obtaining a dental education the cost of dental service to the public will increase. Some one must stand this additional cost, and, as usual, the public pays. In our zeal for the improvement of the status of dentistry, we are liable to overlook one of the most important considerations—furnishing dental service to the rank and file of people, and at a cost which they can afford to pay. While I am fully aware of the value of higher education, it is, nevertheless, my opinion that these wantonly extended courses can claim neither soundness of economics nor efficiency of operation as an excuse for their adoption.

In our country, the approved schools of medicine require, for entrance, in addition to high school training, two years of premedical study in a college of arts and sciences. A few medical schools require three years of premedical college work, and one or two require college graduation for entrance. In addition to the four-year medical course, twelve of the seventy-nine medical schools in the United States require their candidates for the degree to spend a fifth year as an intern in an approved hospital. As you will see, medical education also goes to the extreme in some instances. From the foregoing, it will be observed that the study of medicine in the approved and more conservative schools embraces six years, in addition to high school work, while dentistry requires a minimum of

five years of study in addition to high school work. When we contemplate the fact that the first medical college in America was established 160 years ago, and that the first dental college in the entire world was established only eighty-six years ago, and consider further that there is only one year less of preparation required for dentistry than for medicine, we are impressed with the truth that dentistry has made wonderful progress, and has firmly established itself as a vastly important branch of health service. I do not mean to infer that the teaching of dentistry as a separate branch of health service has been wholly responsible for the progress made, for I believe that if the medical profession had been far-visioned enough to realize the importance of dentistry as a branch of the healing art, and had cooperated with the schools of dentistry, it is probable that even greater progress would have been made.

This brings us up to the present status of dentistry as a branch of health service. The following questions naturally arise: What is the relation of dentistry to medicine? Is it a branch of medicine? What is the jurisdiction of the dentist? What present phase of dental education needs stressing most? What lines will dental education follow in the future? What is the future of dentistry itself?

Henry S. Pritchett, president of the Carnegie Foundation for the Advancement of Teaching, said,[1] in regard to the status of dentistry: "In Canada and the United States, the disorders of the teeth have been allotted to dentistry, which has been organized and is now legally defined as a division of the healing art, different from the specialty of medicine."

"It is perfectly clear," he says further, "that dentistry is a form of health service that must be made an oral specialty of medicine, or the equivalent thereto." And he continues, "That dentists and physicians are meeting together to consider their common problems is a hopeful sign that both groups realize that these two professions are not separate and distinct agencies, but two parts of a common health service."

It is obvious that the present tendency in dental education, and in privately conducted research work, is toward a closer consideration of the biologic phases of dentistry. There is a great need now for the cooperation of the pathologist, the chemist, the clinician, the histologist and the dentist in a unified research program. There is still a great need for research work in the matter of diet, although excellent researches into this question have been conducted recently by such men as Howe and McCollum, with amazing results. There is also a great need for further research work in the study of saliva and its relation to the oral structures, and there is a demand for further facts concerning the bacterial organisms of the mouth and accessory sinuses. The Carnegie Foundation, realizing these needs, has appointed a research group and an advisory committee to confer with that group once or twice a year on the investigation of pyorrhea, or periodontoclasia. This advisory committee consists of William C. Ophüls, pathologist at Stanford University; Charles P. Lipman, bacteriologist and physiologic chemist in the University of California, and Jerome H. Allen, a dentist, of Santa Barbara, Calif. The fact that the Carnegie Foundation has seen the necessity for such research work in dentistry should stimulate the rank and file of dentists, as well as the various

1. Pritchett, H. S.: Medicine and Dentistry, J. A. D. A., 13:1160 (Aug.) 1926.

dental schools, to devote more attention to the biologic problems of their work. In the past, dentistry has made great progress in the mechanics of the art (which is highly commendable), but, unfortunately, comparatively little progress has been made in research work along the lines of prevention in dentistry.

The greatest problems which must be solved in the future are those of prevention, rather than cure. In order to master this phase of dental practice, exhaustive research work must be prosecuted. The public must be educated in prophylaxis and diet. The dissemination of this knowledge should take place through legitimate propaganda, particularly that sponsored by the various dental societies. A distinction is to be made between advertising dentistry and advertising the individual practitioner. Advertising by dentists in the United States is regarded as unethical by the American Dental Association and its constituent societies. There must be no guarantees of cures made and no laudatory descriptions of the dentist's methods given in public places. But the dental associations of the United States not only approve, but actually encourage the dentist's efforts to spread the gospel of oral health whenever a legitimate occasion presents itself, such as an address before a school or other public gathering.

Dentists, too often, have been content simply to fill cavities. They have taken it for granted that teeth will always decay, and that their only duty is to repair them. While the day never will come when caries will be entirely prevented, it is logical to conclude that much can be accomplished along the lines of prevention.

Here I anticipate a thought that probably will occur to a few dentists and cause them alarm. If dentists should succeed in a large measure in preventing caries, will not such prevention eliminate the need for their services? In plain words, will they not work themselves out of a job, and kill the goose that lays the golden egg? On the contrary, such a condition would create a greater field for the dentist's services. Who can say that the numerous disease-preventing programs of the medical profession have resulted in a curtailment of the need for the physician's services?

Problems such as the foregoing are more or less clear-cut. But there are problems in connection with dentistry which are not so easy of solution. A particular one with which we are concerned at the present time is the definition of the field of the dentist and of the laboratory man, and the relation between the two. Some of us believe that the dentist should devote less and less time to the mere mechanics of the profession, and that that function should generally be assumed by the laboratory man; while others are of the opinion that the dentist is treading upon dangerous ground when he begins to relegate his mechanical operations to the so-called "dental mechanic," who does not possess the dental degree. It is the opinion of the majority of dentists, as well as my own opinion, that the "dental mechanic" is beginning to encroach on the legitimate field of the dentist. While the situation in America is not particularly alarming, it is, nevertheless, pregnant with harmful possibilities. Frequently, laboratory men, who have never been inside a dental college, refer to themselves as "mechanical dentists." To the layman, who knows nothing of the intricacies of dentistry, this is confusing. The practice has the twofold effect of elevating the laboratory man above his sphere, and at the same time undermining the dentist's standing.

A further indication of the tendency of the laboratory man to go beyond his jurisdiction is found in the recent effort on the part of certain organized laboratory men to influence legislation enlarging their sphere of activity. The dental profession of America has the highest respect for the ethical laboratory man, but it does not countenance the so-called "mechanical dentist."

The future of dentistry depends almost entirely on the dental education of the future. It is my opinion that the dental curriculum in the future will approach more closely the medical curriculum. Dentistry cannot be divorced from medicine, for it is as much a specialty of medicine as dermatology or otorhinolaryngology is. The parts of the human anatomy that come under the dentist's jurisdiction are just as vital as those coming under the jurisdiction of any other medical specialty, and the relationship between the oral cavity and the body general is just as intimate as that existing between the body and any specialized tissue or tissues.

But the training for dentistry is necessarily more technical than that for any of the other specialties. The practice of dentistry requires a high degree of mechanical skill. If the dentist should be required to complete the regular medical curriculum, and, in addition, master the technical side of dentistry, he would possibly not be able to equip himself properly in less than six years. This, coupled with his two years of preparatory college work, would make a total of eight years for the completion of the study of medicine and dentistry. For various reasons, particularly economic, such a course would be impractical in America at this time. Those who have given great thought to the subject are agreed that, eventually, dentistry should be merged with medicine as a specialty of the same, but that neither the medical profession nor the dental profession is ready for such a union now. It has been considered wisest, therefore, to advocate the continuance of the teaching of dentistry as an independent branch of health service.

Reams could be written on the question as to whether dentistry should be made a branch of medicine, but, to my mind, the answer to the following simple question will bring the solution, namely: Has dentistry, as an independent branch of health service, met all its obligations? If it has, there is no need for radical revision in the teaching methods of dentistry or for affiliation with medical schools. If it has not, and if closer cooperation between the medical and dental professions can be assured by merging the two, such action will be justified. The answer remains to be written.

THE GINGIVAL CREVICE

By BALINT ORBAN, M.D., and EMIL MUELLER, M.S., D.D.S., Chicago, Ill.

A REVIEW of the literature on the subjects of histology, pathology and the clinical significance of the gingival crevice affords evidence of further need for study and better comprehension of the subject.

In this country, investigators in histopathologic research, as well as operators in practical dentistry, still do not recognize fully the importance of the observations of Gottlieb on the "epithelial attachment" to the tooth. Through these observations, it has been clearly shown that the old conception of the relationship between the soft and hard tissue around the neck of the tooth is false. Gottlieb described his findings in 1921.[1] The new conception of this relationship has an important practical bearing on periodontal pathology as well as on restorative dentistry. In Europe, especially in Austria and Germany, the observation of Gottlieb on the epithelial attachment is accepted. Considerable disagreement persists with reference to the conditions which bring about detachment of the epithelium from the tooth or stimulate the epithelium to grow along the root surfaces. These relevant discussions do not alter the fact that the attachment of the gum tissue to the tooth is a reality. Knowledge concerning the epithelial attachment is of great significance to both research workers and clinical practitioners. Figure 1 visualizes the differences between the old and the new conceptions. Those upholding the old conception believe that after the tip of the tooth has broken through the epithelium, the entire enamel-covered portion of the tooth, that is, the crown, is exposed. The epithelium is believed to lie close to the surface of the enamel, and is separated from it by the so-called subgingival space. According to the old conception, the epithelium is attached to the tooth only at the cemento-enamel junction. This conception is illustrated at the left side of the diagram in Figure 1. Until now, this conception has been quite generally taught. We present here a picture from G. V. Black's "Special Dental Pathology."[2] (Fig. 2.) Both of Black's pictures correspond to the left side of the diagram in Figure 1. The relationship between the epithelium of the gum, the enamel and the cemento-enamel junction is described by Black as follows:

> The free gingivae are soft tissue processes. . . . This part of the tissue has no attachment to the teeth after passing occlusally of the gingival line, but is simply closely fitted about them: hence the term free gingivae. The height of the free gingivae upon the teeth is variable, from one to five millimeters, sometimes even higher in children. In rising on the gingival portions of the crowns of the teeth, the gingivae thin away to a knife-edge margin. A thin blade may

1. Gottlieb, Bernhard: Der Epithel Ansatz am Zahne, Deutsch. Monatschr. f. Zahnheilk., No. 5, p. 142, 1921.

2. Black, G. V.: Special Dental Pathology, Chicago: Medical Book Publishing Company, 1915.

readily be passed between the gingiva and the subgingival space between it and the enamel. *This tissue has no attachment to the tooth until the gingival line on the tooth is reached, which means that the attachment is to the cementum only.*

These teachings of Black have been accepted by research workers as well as by practitioners, and upon the basis of them, important practical conclusions have been drawn.

To illustrate further the old conception of the gingival crevice (subgingival space), we reproduce a picture from F.

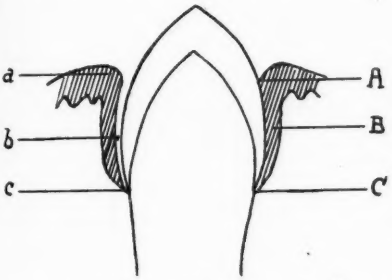


Fig. 1.—Diagram illustrating the difference between the old and the new conceptions of the attachment of the gum to the tooth. The small letters are used to illustrate the old conception; the capitals, the new conception. *a*, free gingiva. *b*, subgingival space. *c*, gingival line. *A*, bottom of the gingival crevice. *B*, epithelial attachment. *C*, cemento-enamel junction (deepest point of the epithelial attachment).

B. Noyes' "Dental Histology and Embryology."[3] (Fig. 3.) The attachment of the epithelium to the tooth ends in a point at the cemento-enamel junction, and the entire enamel is exposed.

The epithelium of the enamel organ is in organic connection with the surface of the enamel even after the enamel has been developed. In unerupted teeth, there is no space between the enamel and the enamel epithelium, but the entire surface of the enamel and the epithelium of the enamel organ have grown together. (Fig. 4.) As the tip of the crown of the growing tooth approaches the mouth epithelium, the enamel epithelium and the mouth epithelium grow together. (Fig. 5.) During further eruption, the tip of the enamel appears in the mouth cavity, but the rest of the enamel epithelium remains in organic connection with the surface of the enamel. (Fig. 6.) The lowest point of separation of the attached epithelium from the surface of the enamel constitutes the bottom of the gingival crevice. The epithelial attachment extends from the lowest point of separation to the cemento-enamel junction. When the tooth erupts, the surface of the enamel below the bottom of the gingival crevice is grown together with the covering epithelium. The gingival crevice, or so-called subgingival space, does not extend to the cemento-enamel junction but is found at that point where the attached epithelium becomes separated from the surface of the enamel. As the tooth reaches the line of occlusion, the entire enamel-covered portion of the tooth (so-called "anatomic crown") is not yet fully exposed to the mouth cavity, but the apical third of the enamel is still in organic connection with the surrounding epithelium. This is the first point that we wish to emphasize.

The next point is the fact that the epithelial attachment to the tooth is not a fixed state; that is, the bottom of the gingival crevice does not remain fixed at one point on the surface of the tooth during the entire life of the individual. It has already been mentioned that, at the time the tooth erupts and the tip of the crown appears in the mouth, only a small portion of the enamel is exposed;

3. Noyes, F. B.: Dental Histology and Embryology, Philadelphia: Lea & Febiger, 1921.

the larger part of it is still in organic connection with the surrounding epithelium. Gottlieb considers as erupted that portion of the crown which extends from the bottom of the crevice to the tip of the crown. He designates this portion as the "clinical crown." In contrast to the clinical crown, he calls that portion of the tooth covered with enamel the "anatomic crown." A term that finds some clinical usefulness has been introduced by H. G. Oppice. In addition to the designations of Gottlieb, he also

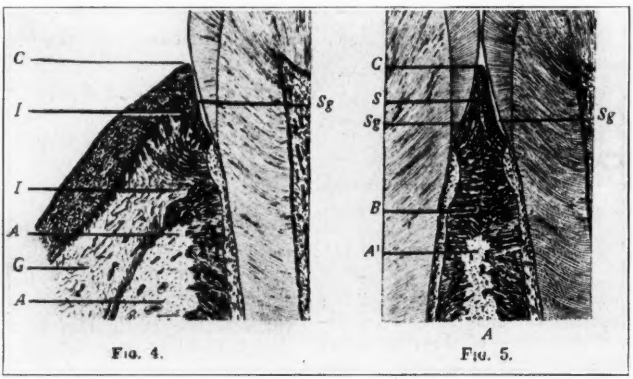


Fig. 4. Fig. 5.

Fig. 2.—Figures 4 and 5 of G. V. Black's "Special Dental Pathology." *Sg*, subgingival space.

recognizes the "visible crown." By that, he means that part of the tooth which is outside the free margin of the gum.

In young individuals, the clinical crown is smaller than the anatomic crown. The anatomic crown remains the same (if we leave out of consideration abrasion), while the clinical crown constantly becomes larger. Through gradual separation of the epithelium from the surface of the tooth, the bottom of the gingival crevice shifts closer and closer to the cemento-enamel junction. The rate of separation varies in different individuals. Sometimes, it advances slowly; at other times, more rapidly. Not only the bottom of the gingival crevice, but also the whole epithelial attachment shifts apically, so that finally that portion of epithelial attachment which was at the cemento-enamel junction grows along the cementum on the surface of the root. This is illustrated in Figure 7. The deepest point of the epithelial attachment passes over the cemento-enamel junction and grows along the root. It is a rule without exception that the deepest point of the epithelial attachment always grows along the cementum before the bottom of the gingival crevice reaches this point in its shifting; consequently, the bottom of the gingival crevice and the deepest point of the epithelial attachment never can be at the same point at the same time.

The eruption of a tooth is not completed at the time that it comes into occlusion with its antagonist. At this time, only two-thirds of the anatomic crown is clinically erupted. That means that one-third is still in organic connection with the epithelial attachment. If no pathologic conditions intervene, attach-

ment to the enamel may continue for a long time, approximately to the age of 30 or longer; that is, the bottom of the gingival crevice remains for twenty or thirty years on the surface of the enamel.

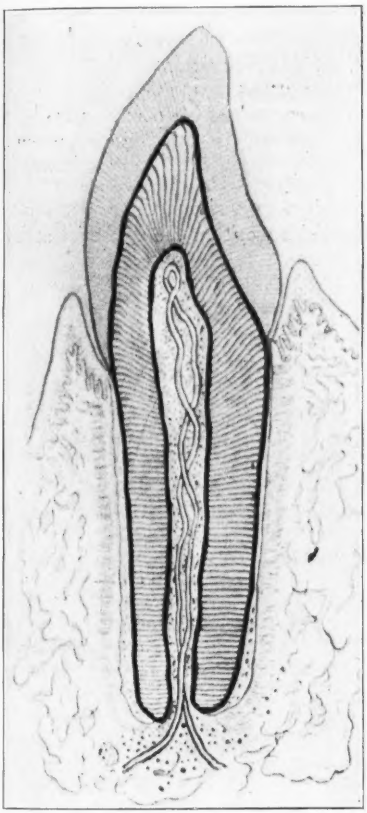


Fig. 3.—Plate I of F. B. Noyes' "Dental Histology." This picture corresponds to the old conception in Figure 1.

Gradually, the epithelium grows along the root toward the apex; the bottom of the gingival crevice approaches, then reaches and finally passes the cemento-enamel junction.

As the bottom of the crevice reaches the cemento-enamel junction, the clinical crown is identical with the anatomic crown. But this stage is only a moment in the life of the tooth, for the epithelium remains at this point no longer than at any other point of the tooth surface. As the bottom of the gingival crevice passes the cemento-enamel junction, and cementum becomes exposed, the clinical crown gradually becomes larger than the anatomic crown.

For convenience, we have classified this shifting of the epithelial attachment into four stages. Figure 8 illustrates these stages. The classification is based on microscopic measurements[4] obtained from hundreds of human teeth. From these measurements, we obtained much new information concerning the relationship of the free margin of the gum, the depth of the gingival crevice, the epithelial attachment and the other adjacent structures.

The gingival crevice (Fig. 9) may be defined as a space surrounding the tooth, limited on one side by the surface of the tooth, on the other by epithelium called the crevice epithelium. The junction of the crevice epithelium with the mouth epithelium constitutes the free margin of the gum. The bottom of the gingival crevice is at that point where the crevice epithelium is attached to the tooth. From this point apically, the epithelial attachment extends.

It is very difficult to define a "normal" gingival crevice. Should we call normal every crevice which is not pathologic? That brings up the question as to what we consider pathologic conditions of the gingivae. Microscopically, inflammation may always be found in the subepithelial

4. Orban, Balint, and Köhler, J.: Die Physiologische Zahnfleischtasche, Ztschr. f. Stomatol., No. 6, p. 353, 1924.

gum tissue. Seldom does one find human specimens without some signs of inflammation. It is therefore quite impossible to define a normal gingiva; but it is of practical significance to discuss what should constitute an ideal gingival crevice.

There are varying views in the literature concerning the normal depth of the gingival crevice. Generally, the investigators believe that the depth ranges from 1 to 2 mm. Gottlieb[5] contends that the shallower a crevice, the more nearly it approaches the ideal. This does not mean that because a crevice is 1, 2 or more millimeters deep, it must be pathologic. We see deep crevices without pathologic changes in the tissues; and, vice versa, shallow crevices with pathologic conditions. But there is more likelihood of a pathologic condition developing in conjunction with deep than with shallow crevices. Consequently, the ideal crevice is a very shallow one. The epithelium of the crevice should be continuous and well hornified on the surface.

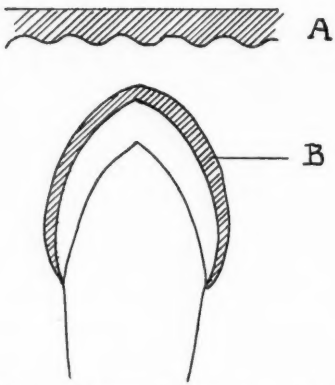


Fig. 4.—Diagram illustrating a tooth before eruption. *A*, mouth epithelium. *B*, enamel epithelium in organic connection with the enamel.

No study of the pathology of the gingival crevice and no rational treatment of the diseases of these crevices can be adequately carried out without a thorough knowledge of the physiology. H. K. Box writes:[6]

> The importance of histopathology in the field of periodontia need not be emphasized, as it is a self-evidenced fact that scientific diagnosis must be based upon an appreciation of this science.

This was written three years after Gottlieb's work on the epithelial attachment had been published. Box describes the attachment of the gingivae just as Black previously described it. He failed to recognize the attachment and apparently had not heard of the studies of Gottlieb. To quote Box again:

> Rising from the cemental gingivae and supported by them are wedge-shaped tissue extensions which encircle the enamel at the cervix. These are known as the marginal

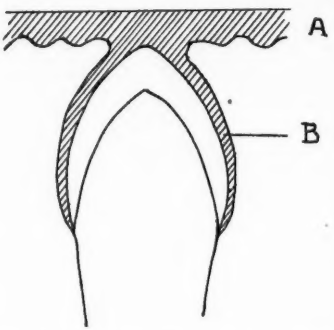


Fig. 5.—Diagram illustrating a tooth a little further advanced in eruption than that in Figure 4. *A*, mouth epithelium. *B*, enamel epithelium. The epithelial tissues are united.

5. Gottlieb, Bernhard: Atiologie und Prophylaxe der Zahncarjes, Ztschr. f. Stomatol., No. 3, p. 129, 1921.

6. Box, H. K.: Studies in Periodontal Pathology, Bulletin of Canadian Dental Research Foundation, No. 7, 1924.

gingivae. By their contact with the enamel, they form the so-called gingival crevice, the *deepest portion* of which is bounded by the *first attachment of the cemental* gingivae at the amelo-cemental junction.

This ambiguous description of Box's is illustrated in Figure 10. (Figure 2 of Box's original paper.) It shows the bottom of the gingival crevice at *a*. We have known since 1921 that the space which is here described as gingival space is that previously occupied by the enamel lost during decalcification in preparation of the specimen. The epithelium shown here is the epithelial attachment grown together with the enamel. The bottom of the gingival crevice is at *b* as far as

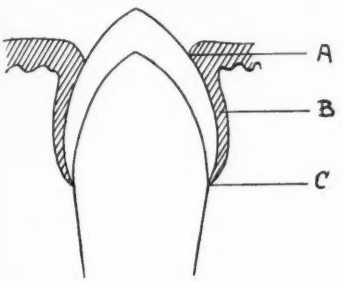


Fig. 6.—Diagram showing a tooth with the tip of the enamel erupted. *A*, bottom of the gingival crevice. The tooth is erupted to this point. *B*, epithelial attachment in organic connection with the enamel. *C*, cemento-enamel junction.

may be determined from this picture. The practical conclusions of Box concerning this figure are as follows:

The distribution of the epithelium on the crevicular surface of the marginal gingivae is worthy of special note because, as a rule, it is unusually thin. Occasionally breaks can be noticed in this lining where the epithelium is absent, and again, imperfect junctions of the crevicular epithelium with the cementum are frequently observed. These *facts*—its extreme thinness, the possible presence of breaks on the surface and imperfect junctions—render this crevicular surface the weakest link in the chain of the epithelial cordon in the mouth.

Only a series of errors can give rise to such deductions. The epithelium described as crevicular epithelium of extreme thinness is not the crevicular epithelium but the epithelial attachment. Since this epithelium is grown together with the tooth, it is not a "weak link," because it is not exposed to the mouth. The breaks can be only artefacts due to technical shrinkage. This applies to the epithelial attachment as well as to the cemento-enamel junction. These have nothing to do with pathology. This conception of Box has very unfortunately found its way into the most recent text-

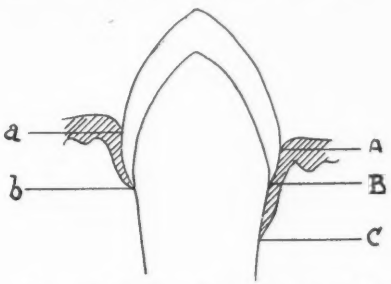


Fig. 7.—Diagram to illustrate the fact that the epithelium grows along the cementum before the bottom of the crevice is found at the cemento-enamel junction. *a*, bottom of the gingival crevice. *b*, cemento-enamel junction, the end of the epithelial attachment. *A*, bottom of the crevice. *B*, cemento-enamel junction. *C*, end of the epithelial attachment on the cementum.

book of Bunting on dental pathology.[7] It is difficult to understand how this conception can be made the basis of an accurate pathologic discussion.

Box's pathology and treatments are based on these misconceptions of the normal histology of the gingival crevice.

7. Bunting, R. W.: A Textbook of Oral Pathology, Philadelphia: Lea & Febiger Co., 1929.

Stillman and McCall[8] also accept as a basis for their work these misconceptions of Box. They write:

> The gingivae . . . by their contact with the enamel, form the gingival crevice, a space which extends to the amelo-cemental junction.

Since the treatise of Box appeared, Gottlieb has visited him, during 1926, and since then, Box[9] has found it necessary to make "some slight modifications of (his) former viewpoint—but the theory of periodontal pathology in its main aspects seems definitely to be affirmed by these later studies."

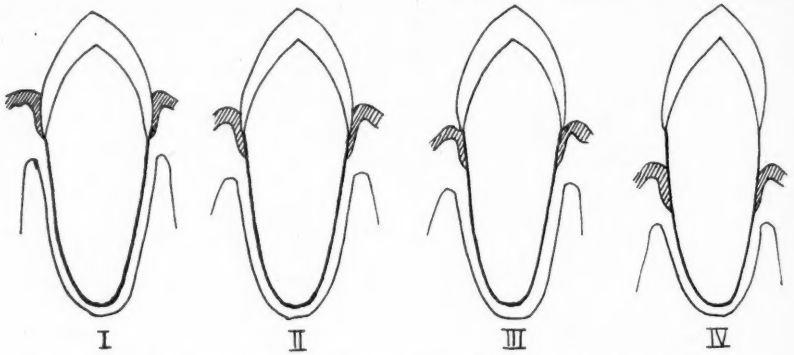


Fig. 8.—Diagram illustrating four different stages of the relationship existing between the tooth and the surrounding tissues, especially the epithelial attachment. *I,* bottom of the crevice on the enamel, deepest point of the epithelial attachment at the cemento-enamel junction. *II,* bottom of the crevice still on the enamel, but the deepest point of the attachment is already on the cementum. *III,* bottom of the crevice just at the cemento-enamel junction; the epithelial attachment on the cementum. *IV,* bottom of the crevice on the cementum, the deepest point of the epithelial attachment shifted further apically.

Box has now accepted Gottlieb's findings on the epithelial attachment. The reader not thoroughly familiar with the literature will hardly recognize this fact. Little stress is laid on it. The description of the epithelial attachment is given in connection with many other bibliographic references which have nothing to do with the epithelial attachment. The basis, the normal histology, has been changed, but "the theory of periodontal pathology seems to be affirmed."

In Figure 11 is reproduced a photomicrograph from a paper of Newton G. Thomas.[10] He says:

> Figure 14 pictures the gingival space of a tooth fully erupted and almost in occlusion with a lining of columnar epithelium.

At *A,* the author states, is the "gingival space." Thomas finds it somewhat peculiar but of "negligible interest" that the "gingival space" should be lined with columnar epithelium. The presence of columnar epithelium lining the "gingival space" should have made a presumably skilled histologist such as Newton G. Thomas at least skeptical. Such an unusual finding should have aroused enough interest to lead to further investigations

8. Stillman, P. R., and McCall, J. O.: Textbook of Clinical Periodontia, New York: The MacMillan Co., 1922.

9. Box, H. K.: Treatment of the Periodontal Pocket, The University of Toronto Press, 1928.

10. Thomas, N. G.: Observations on the Development and Function of the Enamel Organ, J. A. D. A., 12: 255 (March), 1925.

and should not have been lightly dismissed by designating the finding as being of "negligible interest." A little superficial perusing of the literature would have supplied Thomas at least with the information as to the existence of an epithelial attachment on the enamel. We know that *A* is not the gingival space but the space formerly occupied by the enamel. The columnar cells

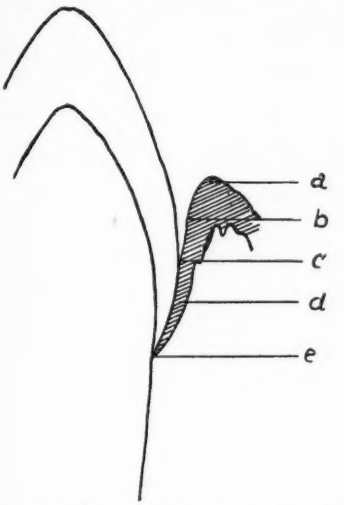


Fig. 9.—Diagram of the gingival crevice. *a*, free margin of the gum. *b*, crevice epithelium. *c*, bottom of the gingival crevice. *d*, epithelial attachment. *e*, cemento-enamel junction, deepest point of the epithelial attachment.

build the enamel and are therefore in organic connection with it. They disappear before the separation of the epithelial attachment takes place. The gingival space does not show in this picture.

In the textbook of Charles F. Bödecker, we find:[11]

> The gingival crevice or subgingival space is formed by the contact of the marginal gingivae extending to the cemento-enamel junction.

This is illustrated with diagrams that do not correspond to actual conditions.

From Broomell and Fischelis,[12] we quote:

> That portion of the gum-margin beyond the cervical line is in close contact with the neck of the tooth, but is not adherent to it, the connecting medium, the alveolo-dental membrane not being present to form the attachment.

It is now quite evident that this interpretation is equally false.

J. A. Marshall writes:[13]

> The normal gum contour under healthy conditions follows the edge of the enamel at the tooth cervix.

With this conception of the normal gingival crevice as his basis, he describes the pathologic condition of the crevice; i. e., pyorrhea.

From Mummery, we also quote:[14]

> At the neck of the tooth, we have a sulcus or trough lined with epithelium and strengthened below by a firm fibrous band, the circular ligament. This trough is said to be sterile in a healthy mouth, and its integrity is of vital importance to the health of the tooth.

In his Figure 203, Mummery shows a diagram which corresponds to those from Black and Noyes.

Endelman writes:[15]

> The gingival lining in the subgingival space—the epithelial cells which line the free gingivae internally—under normal con-

11. Bödecker, C. F.: Fundamentals of Dental Histology and Embryology, New York: The MacMillan Co., 1926.

12. Broomell, I. N., and Fischelis, Philipp: Anatomy and Histology of the Mouth and Teeth, Philadelphia: P. Blakiston's Son & Co., 1917.

13. Marshall, J. A.: Diseases of the Teeth, Philadelphia: Lea & Febiger Co., 1926, p. 275.

14. Mummery, I. H.: Microscopic and General Anatomy of the Tooth: The Oxford University Press, 1924.

15. Endelman, Julio: Special Dental Pathology, St. Louis: C. V. Mosby Co., 1927.

ditions reaches to the cemento-enamel junction. . . . A microscopic section . . . will readily demonstrate that the subgingival epithelium terminates at the cemento-enamel junction and therefore epithelium is not, under normal conditions, in direct relations with cementum *except* at the *very apex of the subgingival crevice.*

This means that Endelman believes that, under normal conditions, the "very apex of the subgingival crevice" is at the cemento-enamel junction. This interpretation falls into the same category as the previous ones.

In Burchard and Inglis,[16] we read:

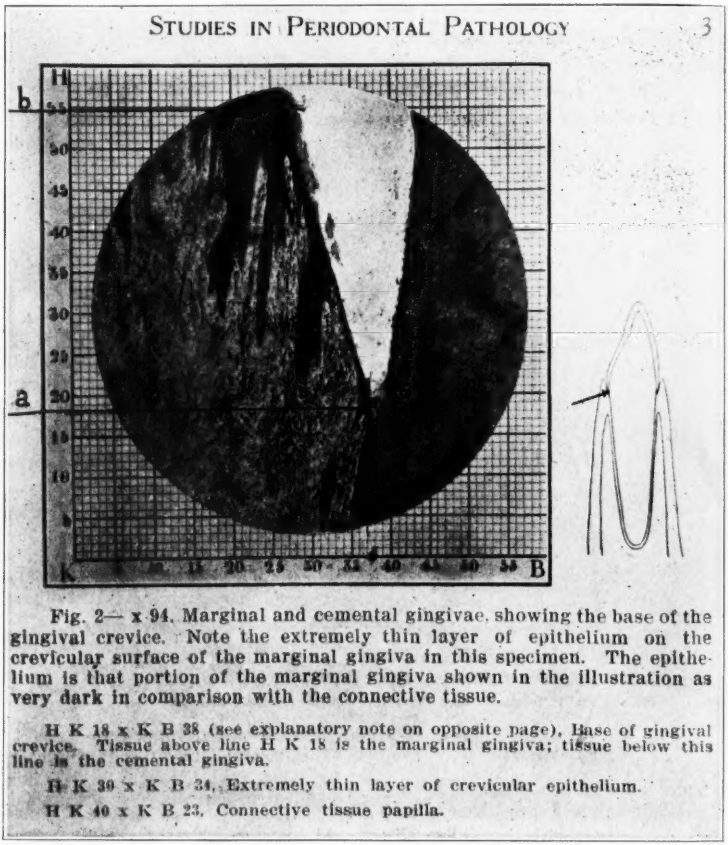


Fig. 2— x 94. Marginal and cemental gingivae, showing the base of the gingival crevice. Note the extremely thin layer of epithelium on the crevicular surface of the marginal gingiva in this specimen. The epithelium is that portion of the marginal gingiva shown in the illustration as very dark in comparison with the connective tissue.

H K 18 x K B 38 (see explanatory note on opposite page). Base of gingival crevice. Tissue above line H K 18 is the marginal gingiva; tissue below this line is the cemental gingiva.

H K 30 x K B 34. Extremely thin layer of crevicular epithelium.

H K 40 x K B 23. Connective tissue papilla.

Fig. 10.—Figure 2 of Box's "Studies in Periodontal Pathology." Box describes the bottom of the crevice as being at *a*, but it is in reality at *b*.

The marginal gingiva is that which has no attachment to the tooth, there being between the two a normal gingival crevice

16. Burchard, H. H. and Inglis, O. E.: Dental Pathology and Therapeutics, Philadelphia: Lea & Febiger Co., 1926.

(or trough) lined on the one side with epithelium and on the tooth side by Nasmyth's membrane covering the enamel at that point. This is originally also an epithelial structure. (Fig. 641.) This crevice is normally about 2 mm. in depth.

Figure 12 is a reproduction of their Figure 641, which, according to these authors, shows the normal gingival crevice. The same picture is again reproduced by them in Figure 577, and is reprinted from the book of Noyes. It is not a specimen from a human tooth, but one from a sheep, and not a normal but a pathologic specimen. The cementum covering the enamel and the dentin is described as Nasmyth membrane. Since in the sheep's tooth there is no cemento-enamel junction, this picture cannot very well be used for illustrating the normal gingival crevice of the human teeth. The same mistake concerning Nasmyth membrane was made by E. S. Talbot[17] in his "Interstitial Gingivitis," in 1899. The picture copied from an article by G. V. Black, illustrated by F. B. Noyes, also points to the cementum as Nasmyth membrane. The same picture is also found in the book of Hopewell-Smith.[18] Figure 13 shows a picture from Hopewell-Smith (his Fig. 262), with a faulty description. According to his conception, *c* is the "pocket of gum, the edge of which is attached to the margin of cementum." By this time, it should be clear that *c* is the space that was previously occupied

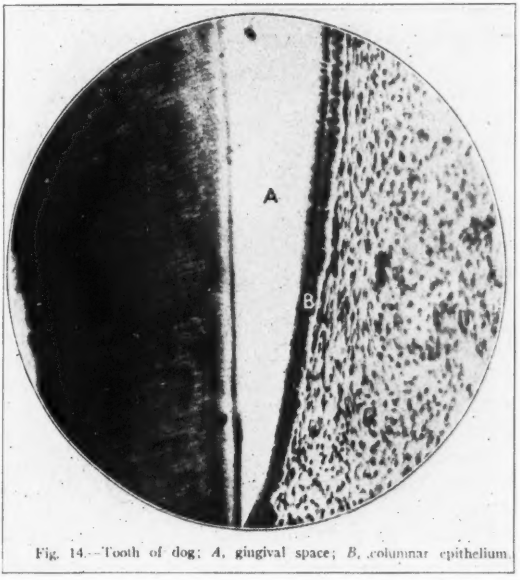


Fig. 14.—Tooth of dog; *A*, gingival space; *B*, columnar epithelium.

Fig. 11.—Figure 14 from a paper of Newton G. Thomas in which he states that *A* is the gingival space. This is a mistake.

17. Talbot, E. S.: Interstitial Gingivitis, Philadelphia: The S. S. White Co., 1899.

18. Hopewell-Smith, Arthur: Normal and Pathological Histology of the Mouth, Philadelphia: P. Blakiston's Son & Co., 1918.

by the enamel, and the gingival crevice is the space between *D* and the gum *E*. A higher magnification of the same specimen is shown in Figure 14, with the following description:

A. Free edge of cementum; B. Oral epithelium of gum tissue. Above A is a shallow pocket filled with pus during life.

That there is no pocket above *A* is evident. The epithelium here and the enamel were grown together. There could have been no pus at this place. *B* is the epithelial attachment growing along the root.

Sorrin and Miller,[19] in their "Practice of Periodontia," describe the gingival crevice and epithelial attachment by quoting Gottlieb. Two photomicrographs used to illustrate this description are falsely interpreted. In their description of the pictures, they confuse the space occupied by enamel with the gingival crevice.

It is only natural that clinicians should find it necessary to seek support for their clinical observations and contentions with histologic and pathologic explanations. It is regrettable that they remain on the surface of the study and do not penetrate deeply enough into the subjects to find adequate bases.

This short and incomplete survey of literature is sufficient to account for the numerous misconceptions that persist among practitioners pertaining to the physiology and pathology of the gum margin and the gingival crevice. The only original article in this country which treated this subject authentically was that by Skillen and Mueller.[20] The only book to treat it correctly is that of Herman Prinz,[21] from which we quote:

Up to the present, anatomists regarded the space existing between the crown of a tooth and its gum, at the time of the eruption, to reach the cemento-enamel junction. Gottlieb, however, was able to show that this conception is misleading.

To the present day, there are many phases that are extensively discussed in the foreign literature concerning the processes which take place at the gum margin, at the bottom of the gingival crevice, and at the end of the epithelial attachment. We shall not discuss the various interpretations pro and con concerning these phenomena. We refer the reader to the original literature.

In order that we may be able to form a true conception of the facts, abundant material, particularly human material, must be studied. We do not want to minimize the importance of the study of animal material; but before we can legitimately transfer deductions from animal findings to human beings, we must study human material. We have found great differences in the structures and reactions of human tissues in comparison to those of animals. At this point, we shall show specimens from human material. In the description of those tissues, we shall discuss the various questions, and finally draw practical conclusions concerning problems of pyorrhea as well as of operative and prosthetic procedures.

It was stated in the beginning of this paper that the teeth cannot biologically be considered fully erupted when they come into occlusion. At this time, approximately, the gingival third of the enamel is still in organic connection with the epithelial attachment. The question arises: When is a tooth fully erupted?

19. Sorrin, S., and Miller, S. C.: Practice of Periodontia, New York: The MacMillan Co., 1928.

20. Skillen, W. G., and Mueller, Emil: Epithelium and the Physiologic Pocket, J.A.D.A., 14: 1149 (July) 1927.

21. Prinz, Hermann: Diseases of the Soft Structures of the Teeth and Their Treatment, Philadelphia: Lea & Febiger Co., 1928.

Longitudinal section. *Ep*, epithelium lining the gingival space; *Gg*, gingival gland so-called; *D*, dentin; *N*, Nasmyth's membrane; *Du*, duct-like structure stretching away toward the gingiva from the epithelial cord, seen at *Ec*; *Cm*, cementum, separated from the dentin by vitrification. × 50 (about). The long space next to the tooth is made by the detachment of the soft and hard tissues. The space between *N* and *Ep* is the gingival crevice. (Noyes.) (Words modified by Editor.)

Fig. 12.—Figure 641 from the book of Burchard and Inglis. This picture is believed by the authors to show a normal gingival crevice. The gingiva shows extensive inflammation. The specimen originates from a sheep. The same picture appeared in papers of G. V. Black, F. B. Noyes, E. S. Talbot and Hopewell-Smith, and probably others.

The term "fully erupted" is not to be used in the same sense as it has been used up to the present time. We formerly understood by "fully erupted" that the tooth was in occlusion, and that the bottom of the gingival crevice was at the cemento-enamel junction. Even this old conception was not uniformly understood. In the quotation from Newton G. Thomas, we read of a "fully erupted" tooth "almost" in occlusion. Just what does he mean by "almost" in occlusion if the tooth is "fully" erupted? We have seen that the bottom of the gingival crev-

ice is not a fixed point on the surface of the tooth, but is continuously shifting apically, together with the epithelial attachment. As the bottom of the gingival crevice reaches the cemento-enamel junction and passes it, cementum becomes exposed. The cemento-enamel junction is only a line over which the epithelium passes very rapidly. We can never find the bottom of the crevice at the same level all around the tooth. We find conditions on the labial aspect different from those on the lingual, the mesial different from the distal, but we never find a condition in which the whole enamel-covered portion of the tooth is exposed simultaneously on all surfaces. On one side, a portion of the enamel and the epithelium may still be grown together; while, on the other side, the cementum may al-

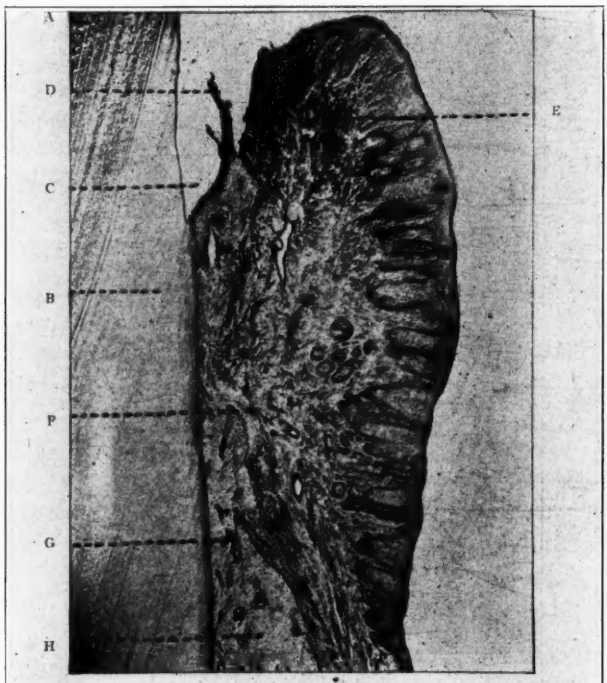


FIG. 262.—Vertical section through canine and bone of right side of mandible of man aged thirty-nine. "Pyorrhœa alveolaris" not marked. Tissues over external aspect. A. Dentine; B. Cementum; C. "Pocket" of gum, the edge of which is attached to the margin of cementum; D. Slight desquamation of oral epithelium; E. Slight inflammation of gum; F. Edge of alveolar bone transformed into osteoid tissue; bone lacunæ and corpuscles indistinguishable; G. Hyperplasic periodontal membrane; blood-vessels injected; H. Normal bone. Magnified 35 times.

Fig. 13.—Figure 262 from the book of Hopewell-Smith. The gingival crevice is not at *C*, as the author states, but between *D* and *E*.

ready be exposed. We cannot correctly speak of a fully erupted tooth in the biologic sense. Clinically, we may understand that the tooth is erupted after it reaches the occlusal line.

the paper of Gottlieb[22] in which he shows four different conditions of four human specimens. The pictures correspond to the four stages in tooth eruption, but it is quite evident that between these stages

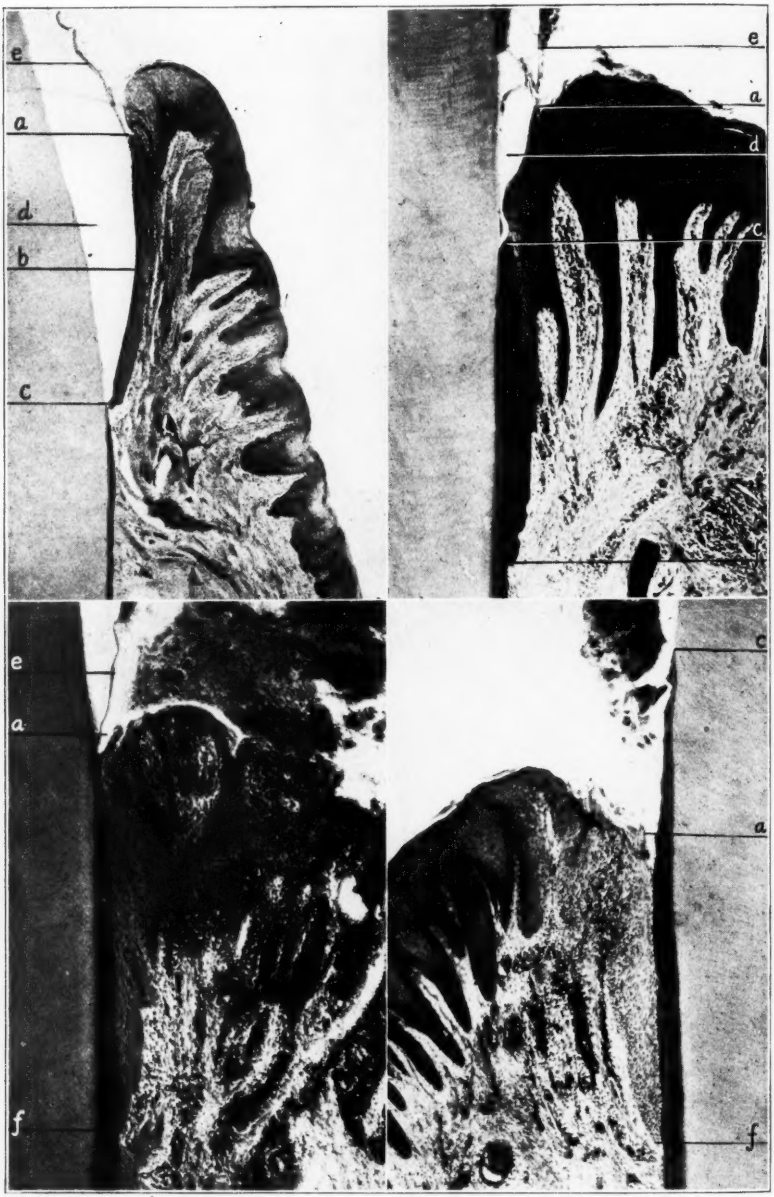
Fig. 274.—Same as Fig. 262. A, Free edge of cementum; B, Oral epithelium of gum tissue. Above A is a shallow pocket filled with pus during life. Magnified 350 times.

Fig. 14.—Higher magnification of Figure 262 (Fig. 13). The pocket is not above *A*, but this marks the space formerly occupied by the enamel. No pus could have been there during life, as the author supposed.

The eruption of teeth is grouped into four stages. These groups are illustrated in Figure 8, but this grouping is used only for illustrating different stages of a continuous biologic process. These four pictures have their corresponding microscopic and clinical stages. We refer to many intermediate stages exist. We reproduce the four pictures in Figures 15-18.

The depth of the gingival crevice in these photomicrographs is about equal

22. Gottlieb, Bernhard: What Is a Normal Pocket? J.A.D.A., 13: 1747 (Dec.) 1926.



Figs. 15, 16, 17 and 18.—Gingival crevices from human specimens, which correspond to the four stages illustrated in Figure 8. *a*, bottom of the gingival crevice. *b*, epithelial attachment. *c*, cemento-enamel junction. *d*, enamel. *e*, cuticle. *f*, deepest point of the epithelial attachment.

to the thickness of the epithelial covering of the gum, about 0.1 mm. A crevice never can be too shallow, for the deeper the crevice, the more possibilities there are for its becoming pathologic.

The distal side of an upper molar of a young person is shown in Figure 19.

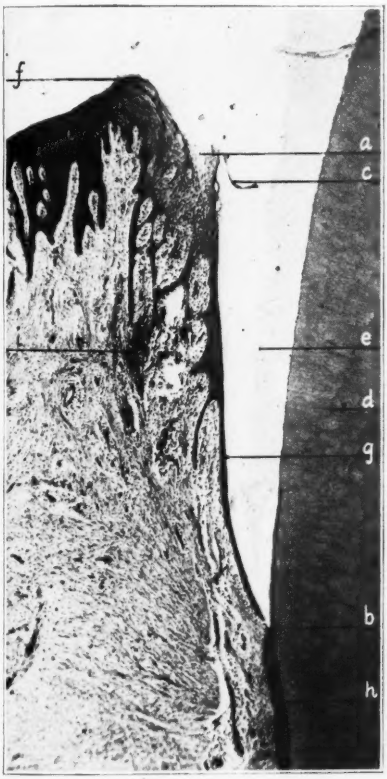


Fig. 19.—Distal side of an upper molar of a young person. *a*, bottom of the crevice. *b*, cemento-enamel junction. *c*, enamel cuticle. *d*, dentin. *e*, enamel. *f*, free margin of the gum. *g*, epithelial attachment. *h*, cementum. *i*, inflammation in the subepithelial tissue.

This individual died of tuberculosis. The bottom of the gingival crevice is seen at *a*, and not at *b*, which is the cemento-enamel junction. The epithelium from *a* to *b* constitutes the epithelial attachment. This epithelium is thin, but that has nothing to do with a pathologic periodontal condition. No bacteria or food or anything else can go through this epithelium, because it is united with the enamel. There is no space between the enamel and the epithelium. An instrument can be passed freely between the enamel and the epithelium only to the bottom of the crevice *a*. If we force an instrument, we may separate the epithelial attachment from the enamel. We shall speak later of the dangers of this procedure. This separation, if carefully done, will not be accompanied by pain and bleeding, because the epithelium has no blood vessels. If the epithelium becomes severed and the connective tissue is exposed, we may have bleeding from the connective tissue. This picture shows what we call a young stage in tooth eruption. It corresponds to Figure 8, diagram 1, and to Figure 15. The deepest point of the epithelial attachment ends at the cemento-enamel junction, generally called the gingival line. This term should be discontinued because it is based upon a misconception. It was believed that the free gingiva ended at this point and was attached to the tooth here. After the description of the eruption of the teeth and the study of Figure 8, given here, we know that the cemento-enamel junction, formerly called the gingival line, has no biologic clinical or functional significance. Since the epithelial attachment is, in the earlier ages, on the enamel and, in the later ages, on the cementum, the borderline between the two, the cemento-enamel junction, cannot correctly be called the gingival line. The free gingiva is that portion of the gingiva which is outside the bottom

of the gingival crevice. In Figure 19, the free gingiva extends from *a* to *f*, which constitutes the free margin of the gum. The epithelium from *a* to *f* borders the crevice and is called the crevice epithelium. In this case, we find inflammation and round-cell infiltration in the subepithelial tissue, but no ulceration in the crevice epithelium, and no pus flow; and consequently no pyorrhea.

The clinicians frequently question that the epithelium is grown together with the enamel. They believe it is only closely fitted, as Black supposed it to be. The answer can be found in many specimens. We know that during the histologic preparation of the specimens, more or less shrinkage takes place in the soft tissues away from the hard tissues. The soft tissues shrink toward the center of the mass. This accounts for the fact that we frequently find tears between the soft and the hard tissues; at other times, in the soft tissues only. In Figure 20, a specimen taken from the distal side of a second bicuspid, we find at *a*, the dentin; at *b*, the enamel (formerly believed to be the gingival crevice); at *c*, the cemento-enamel junction, and at *d*, the epithelial attachment in organic connection with the enamel. The surface of the epithelium toward the enamel is smooth and regular. The epithelium does not end at the cemento-enamel junction in a point, but covers a considerable surface of the cementum (Stage II, Fig. 8, corresponding to Fig. 16). Beneath the epithelium, we observe a space *e*, which is due to a shrinkage of the soft tissues. The connective tissue is torn from the epithelium which is still attached to the enamel. The connection between epithelium and connective tissue is very firm. It must take a great deal of force to separate them. The union between the epithelium and enamel in this case was stronger than the union between the connective tissue and epithelium.

The interdental space between a lower first and a second molar is shown in Figure 21. On both teeth, we observe tears in the epithelial attachment. The gum margin has shrunken away from the calculus *a*. The outline of the calculus corresponds to the outline of the gum. This is quite conclusive evidence that these were in contact during life. The space between calculus and soft tissue shows the amount of preparatory shrinkage. Higher magnifications of Figure 21 should offer evidence to convince any one of the strong attachment of the epithelium to the surface of the tooth. In Figure 22, we see the end of the epithelial attachment on the second molar (*b* of Fig. 21). *a* is dentin; *b*, cementum; *c*, the tear due to shrinkage; *d*, epithelial attachment. The tear did not take place between the cementum and the epithelium, where it would have occurred if the attachment had not been firm. It occurred within the epithelial tissue, leaving some of the cells attached to the cementum, while the remainder were torn away. Connecting bridges can be observed crossing the torn area. Similar conditions are illustrated in Figure 23.

We do not wish to enter into the discussion as to what constitutes this firm attachment. Opinions differ, but absolute evidence is lacking, and the subject is open to further investigation.

The question often raised is: How do we know that the epithelium has grown along the cementum and has not been there from the beginning of development? The cementum is a product of the connective tissue of the periodontal membrane. It is laid down on the surface of the dentin, and it is not possible for the epithelium to lie between the

cementum and the connective tissue from the beginning. The epithelium can cover the cementum only after the connective tissue becomes separated from it.

As formerly stated, the ideal gingival crevice is practically no crevice. We have had the opportunity to observe many cases in which the depth of the gingival crevice was practically naught. Specimens of this kind are not rare, in spite of the fact that our material was obtained largely from human beings who had exercised little oral hygiene.

Figure 24 shows the interproximal space between the upper second and third molars. On the right side of the picture is shown the second molar; on the left side, the third molar. The difference between the two sides is apparent. The left side, the mesial, of the third molar

Fig. 20.—A tear (*e*) between the epithelial attachment (*d*) and connective tissue (*f*). *a*, dentin. *b*, enamel. *c*, cemento-enamel junction. *g*, cementum.

shows the bottom of the gingival crevice at *a;* the space formerly occupied by the enamel is at *b*. The surface of the epithelium toward the enamel of the third molar at *c* is smooth. The epithelial attachment extends from the bottom of the crevice occlusally, we see the enamel cuticle. A higher magnification of this region is offered in Figure 25. We here observe very clearly the enamel cuticle passing between the enamel and the epithelial attachment. At this point is the

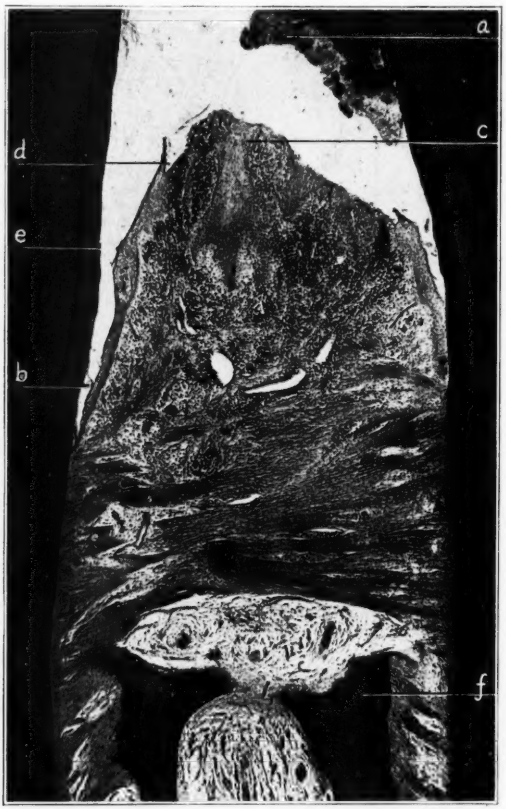


Fig. 21.—Interdental space between a first and a second molar (lower). *a*, calculus. *b*, tear in the epithelial attachment. *c*, gum margin. *d*, gingival crevice. *e*, cemento-enamel junction. *f*, alveolar margin. The space between *a* and *c* is due to shrinkage.

gingival crevice *a* toward the cemento-enamel junction *d*. The end of the epithelial attachment has already grown along the cementum. From the gingival bottom of the gingival crevice, and it is here that the epithelial attachment becomes detached from the surface of the tooth. The depth of this gingival

crevice is practically naught. The crevice on the second molar in Figure 24 (right side) shows a different condition. We see the cemento-enamel junction at *a*. The piece of calculus at *b* indicates the former outline of the enamel before decalcification. The bottom of the gingival crevice is at *C* on the cementum, and the deepest point of the epithelial attachment is at *D*. The crevice is filled with calculus *E*. Pus was discharged into this crevice. At different places on the surface of the crevice epithelium, defects may be seen. These defective places are ulcers from which pus cells were discharged. Pus may be seen in the crevice at *F*. Pressure applied on the outer surface of this gum would force pus from the gingival space, and hence the condition could be diagnosed as pyorrhea.

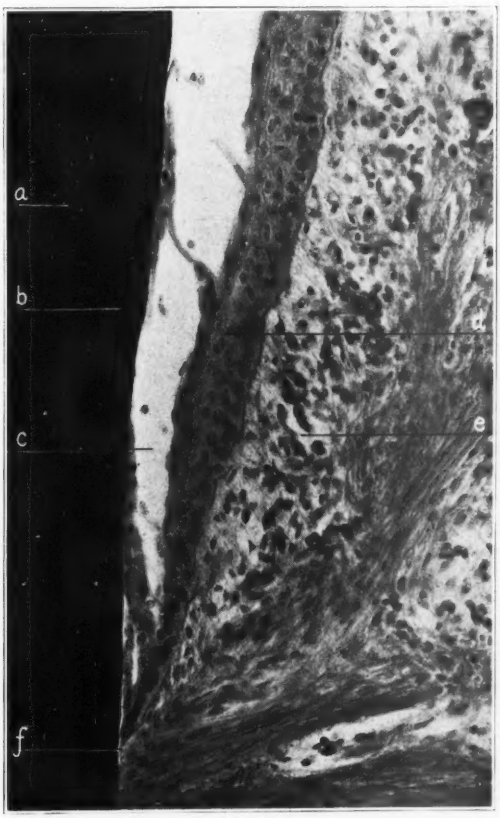


Fig. 22.—Higher magnification of area *b* in Figure 21. *a*, dentin. *b*, cementum. *c*, tear in the epithelial attachment (*d*). *e*, subepithelial inflammation in the connective tissue. *f*, end of the epithelial attachment.

In the same interproximal space, we have a very shallow and a very deep crevice. The shallow crevice is more or less clean, and free from ulcers, with no pyorrhea; the deep crevice is unclean, full of calculus, shows ulcers and is affected with pyorrhea. Many practitioners contend that they have never seen such shallow crevices in the mouths of patients as we show in our specimens. Those that devote themselves to prophylactic treatment and proper methods of brushing, if close observers, see many such shallow crevices. We seldom see a mouth in ideal hygienic condition, but when we do, we very often find shallow crevices. The better the mouth hygiene, the better the condition of the gingival crevice, and the shallower the crevice.

It is surely not justifiable to question the superiority of histologic observation over clinical observation. This has often been attempted. The microscope was introduced because man's naked eye was incapable of seeing everything. The microscope magnifies hundreds of times the things that we see in the clinic. It is a fact that we find crevices in the microscope with almost no depth, and therefore we must and can also find them in the mouths of patients. Upon the basis of microscopic investigations, we have never been able to find an objection to shallow crevices, but we have been able to find many objections to deep crevices. The shallower a crevice, the less possibility there is for the deposition of calculus and bacteria.

Observe in Figure 26 the interproximal space between a lower central and a lateral incisor. Calculus fills the whole space between the two teeth and the entire gingival crevice. At *a,* we find the calculus; at *b,* gum tissue. The space between the calculus and epithelium of the gum is due to shrinkage of the soft tissues. The space *c* between the dentin and the calculus was formerly occupied by enamel. The bottom of the gingival crevice is at *d;* the cemento-enamel junction, at *e.* From *d* to *f* is the epithelial attachment. Special attention is called to the right side. The outline of the former enamel is shown by both calculus and epithelial attachment *g.*

It is interesting to compare the epithelial attachment bordering the enamel with the crevice epithelium separated from the surface of the tooth by the calculus. The epithelial attachment from *d* to *e* is smooth. A higher magnification of a portion of the same attachment is shown in Figure 27. We see the hornified cuticle *a* at the borderline between enamel *b* and epithelial attachment *c.* The cuticle is the product of the epithelium; it is hornified epithelium. The epithelial cells in the epithelial attachment, especially those near the enamel, are rather long, and appear to be compressed. They are connected with each other by intercellular bridges. The borderline between cuticle and enamel is a straight regular line. The epithelial surface of the gingival crevice is quite different from the surface of the epithelial attachment. The cells in the crevice (Fig. 28) are not so compressed as in the attachment. They show signs of degeneration, appear swollen and are partly hornified and not smooth on the surface. These two pictures (Figs. 27-28) show quite clearly the difference between the attached and the unattached epithelium. Figure 29 is taken from the bottom of the gingival crevice. We see a tear in the cuticle, and we see the epithelium becoming separated from the cuticle. The epithelial cells are degenerated and loosely connected with each other. Degenerated epithelial cells and leukocytes are to be seen also on the surface of the cuticle. Be-

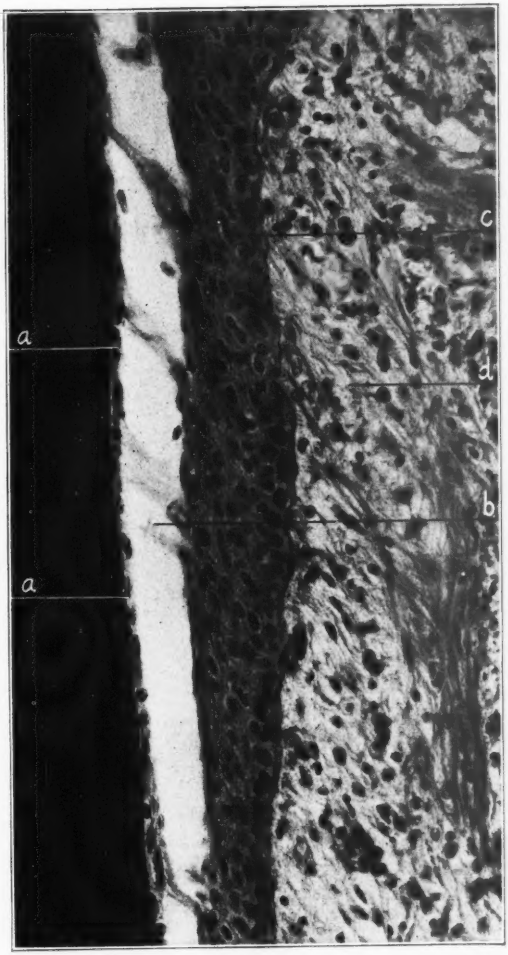


Fig. 23.—Conditions similar to those shown in Figure 22. *a*, epithelial cells remaining attached to the cementum after the tear occurred. *b*, tear. *c*, epithelium. *d*, subepithelial connective tissue.

tween cuticle and enamel, there are no deposits. This finding illustrates that the crevice develops between the cuticle and the epithelium. The cuticle is a product of the epithelial attachment, and after the epithelium becomes separated from the surface of the tooth, the cuticle remains on its surface.

An explorer pushed into the crevice would stop at point *d* in the case of Figure 26 and could not reach point *e*, the cemento-enamel junction, as previously

supposed. From *d* to *f*, the epithelium is in organic connection with the surface of the tooth.

Observe also the shrinkage in Figure 26. At the point of the epithelium which was at the bottom of the gingival crevice *d*, we see the epithelium turned at a considerable angle. The sharp angle was brought about by the shrinkage of the soft tissues. In this case, the epithelial attachment to the enamel was strong enough to resist tear from shrinkage. The epithelium of the crevice, not being attached, shrunk away with the other soft tissues. The pull that occurred between the attached and the unattached epithe-

Fig. 24.—Interdental space between a second and a third molar (upper). The small letters indicate the third molar; the capitals, the second. *a*, bottom of the crevice. *b*, enamel. *c*, epithelial attachment. *d*, cemento-enamel junction. *A*, cemento-enamel junction. *B*, calculus on the enamel (*G*). *C*, bottom of the crevice. *D*, deepest point of the epithelial attachment. *E*, calculus in the crevice. *F*, pus.

lium brought about this angle in the outline of the epithelium. Calculus fills the entire crevice to the bottom.

We have shown the difference between the epithelium of the epithelial attachment (Fig. 27) and the crevice epithelium (Fig. 28). We have seen the smooth surface of the epithelial attachment. The attachment is the tissue from which the hornified cuticle on the surface of the tooth develops. It is built only at the places where the epithelium is attached to the tooth. If the epithelium later becomes separated from the surface of the tooth, the cuticle remains on the surface. Calculus is laid down on the outer surface of the cuticle.

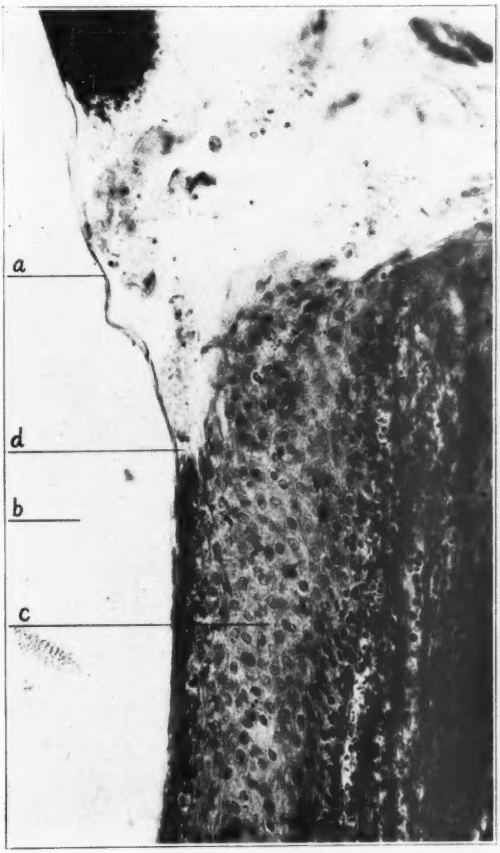


Fig. 25.—Higher magnification of the gingival crevice of the third molar of Figure 24. *a*, enamel cuticle. *b*, enamel. *c*, epithelial attachment. *d*, bottom of the gingival crevice.

We have tried to show up to now that (1) the epithelium is attached to the surface of the tooth, not at the ce-

mento-enamel junction only, but to a considerable surface of the tooth; (2) the bottom of the gingival crevice is not fixed at the cemento-enamel junction; (3) the bottom of the crevice and the end of the epithelial attachment shift of the tooth to the bottom of the crevice.

Figures 30-31 are presented to emphasize a point to which reference has been made in descriptions of previous pictures. Figure 30 is a case from a young individual in which the gingival crevice

Fig. 26.—Interdental space between a central and a lateral incisor (lower). *a*, calculus. *b*, gum tissue. The space between *a* and *b* is due to shrinkage. *c*, enamel. *d*, bottom of the crevice. *e*, cemento-enamel junction. *f*, deepest point of the epithelial attachment. *g*, epithelial attachment. *h*, dentin. *i*, cementum.

continuously toward the apex; (4) the ideal crevice is the shallow crevice; and (5) calculus is deposited on the surface is very shallow. The point that we wish to stress is that calculus deposits are to be found all the way to the bottom of

the crevice. This fact is true of all cases. Figure 31 shows again the calculus filling the entire interproximal space and reaching to the bottom of the crevices of both tooth surfaces.

As mentioned in the beginning of the paper, a knowledge of the structure of the gingival crevice and the epithelial attachment is of importance in both the study and the treatment of diseases of the investing tissues, as well as in restorative dentistry. The gingival crevice has been and still is considered to be a self-cleansing area. With the present knowledge of the epithelial attachment, it is only reasonable that this conception should be revised. After viewing the specimens shown in Figures 24, 26, 30 and 31, it can hardly be claimed that the gingival crevice is self-cleans-

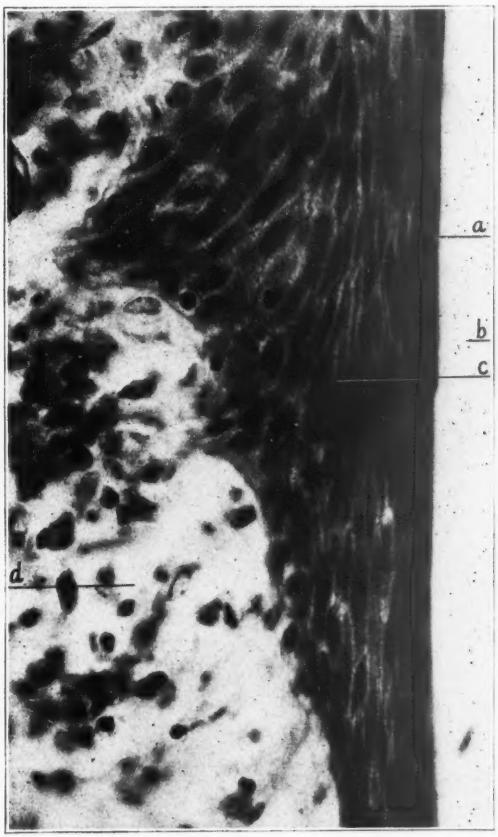


Fig. 27.—Higher magnification of *g* of Figure 26. *a*, hornified enamel cuticle. *b*, enamel. *c*, epithelial attachment. *d*, connective tissue showing chronic inflammation.

ing. We could show many more specimens with conditions similar to those shown formerly.

G. V. Black formulated the famous laws of operative dentistry and taught us extension for prevention. In his operative dentistry, he states that the gingival margins of the proximal cavities must be extended below the free margins of the gums because only those fillings are safe from secondary decay which are protected by healthy gum tissue. As we have shown in the beginning of this paper, the conception of Black concerning the relationship between gum and tooth was incorrect. Although Black was by far the keenest observer clinically as well as microscopically, he failed to detect the true relationship between the hard and the soft tissues at the gingival

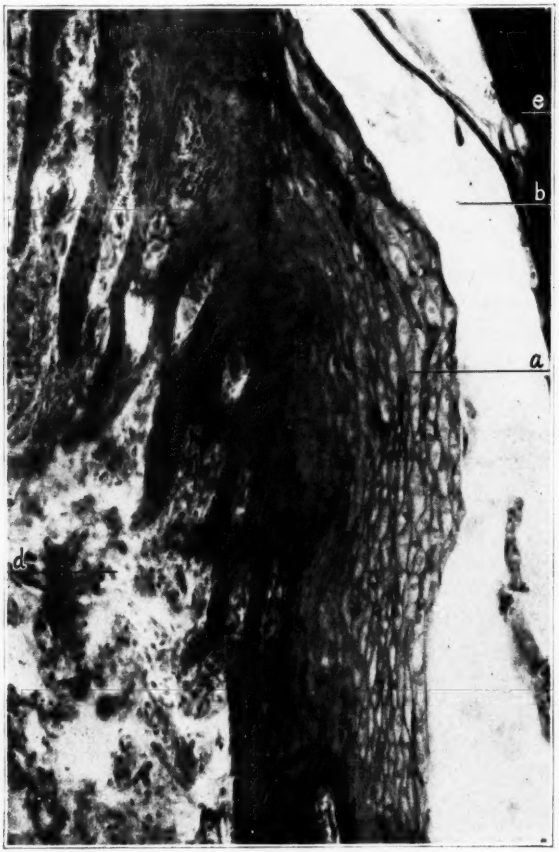


Fig. 28.—Higher magnification of *b*, Figure 26. *a*, crevice epithelium. *b*, space due to shrinkage. *c*, calculus. *d*, connective tissue of the gum.

margin, unquestionably on account of the lack of sufficient human material for microscopic study. His observations pertaining to the recession of the gum in advanced age, the height of the gum in children, etc., are clinical observations made largely on animal material, particularly on material from sheep. And we know today that great differences exist between the teeth of human beings and those of sheep.

The difference between Black's con-

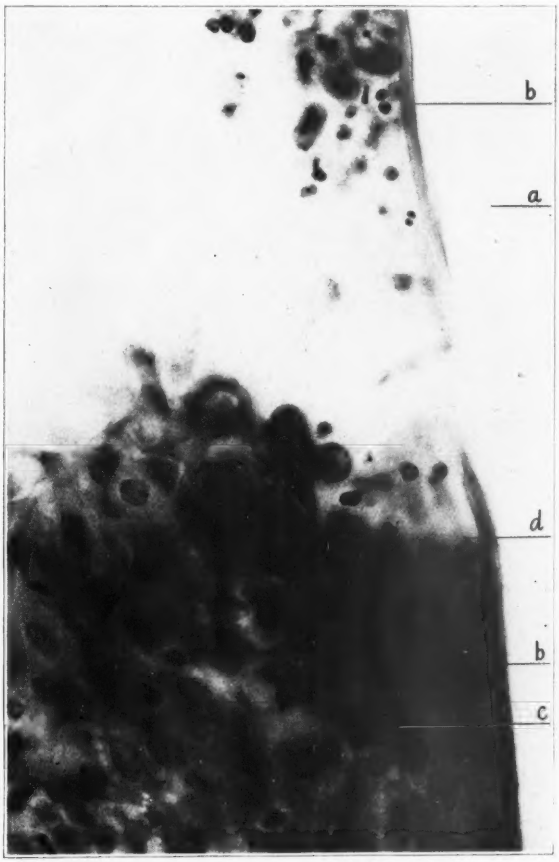


Fig. 29.—Higher magnification of the bottom of the gingival crevice, Figure 26. *a*, enamel. *b*, cuticle. *c*, epithelial attachment. *d*, bottom of the crevice.

that are in absolute conformity with our knowledge of present-day histology. His investigations of the soft tissues were

ception of the attachment of the gum to the tooth, and the conception of Gottlieb has been discussed in connection with

Figure 1, and we again call attention to it. The difference is of practical significance. There is only one possible explanation for Black's observation that the gingival crevice in healthy gum tissue is a self-cleansing area. This is due to the fact that the most susceptible area for caries is at the gum margin. Black found, on extraction of carious teeth from young individuals, that the enamel behind the gum was free from caries. He shows pictures of teeth in such condition in Figures 134-135 and 138-139 in his text on operative dentistry. He con-

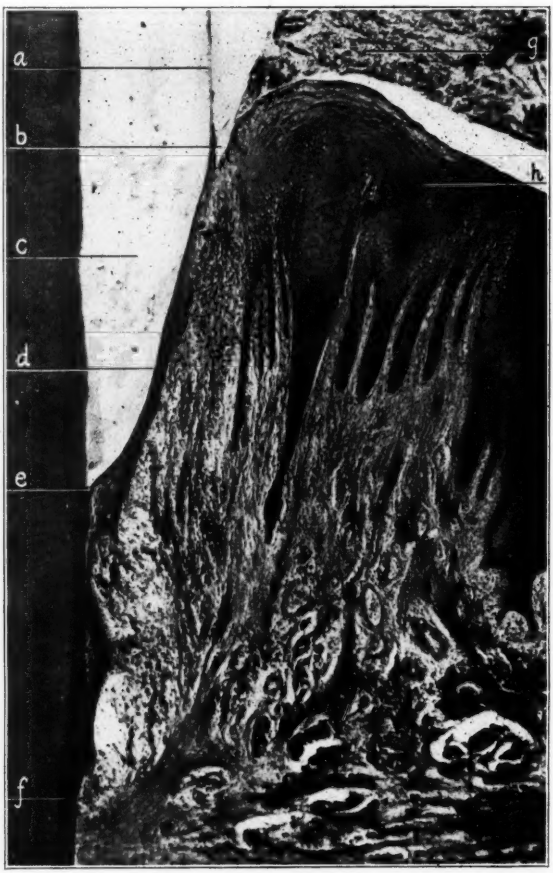


Fig. 30.—Gingival margin of a young person. *a*, enamel cuticle. *b*, bottom of the crevice. *c*, enamel. *d*, epithelial attachment. *e*, cemento-enamel junction. *f*, deepest point of the epithelial attachment. *g*, calculus deposits. *h*, mouth epithelium.

cluded that this smooth enamel surface was protected from caries by the gum tissue. He writes:

For these illustrations (138-139) the cementum has been tinged with a selective anilin stain to show the gingival line distinctly in order to bring prominently into view that portion of the enamel covered by the free border of the gum, illustrating its protection from the beginnings of caries.

From these observations Black made the only logical conclusions: viz., that the gingival crevice is a self-cleansing area.

Since we have knowledge of the epithelial attachment on the enamel, we know that that portion of the enamel which Black saw as clean and smooth was not in the gingival crevice, but

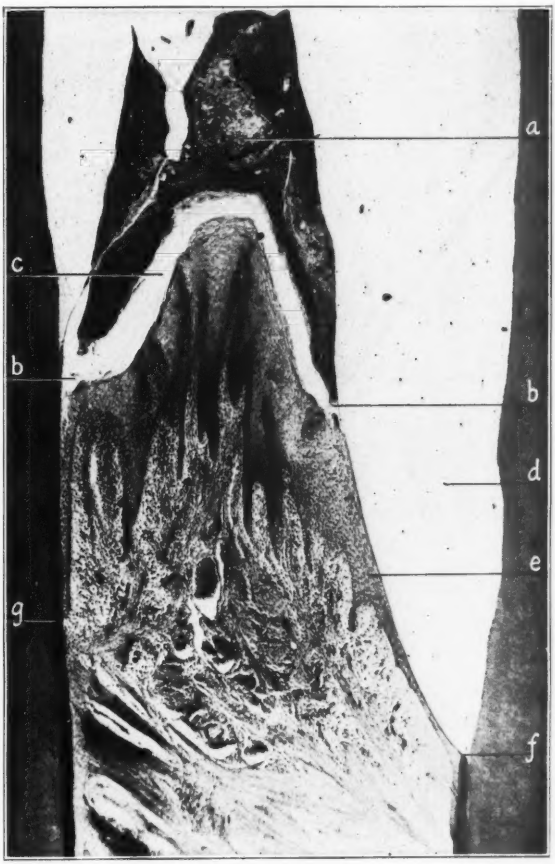


Fig. 31.—Interdental space between two incisors. *a*, calculus. *b*, bottom of the crevice. *c*, space due to shrinkage. *d*, enamel. *e*, epithelial attachment. *f*, cemento-enamel junction. *g*, deepest point of the epithelial attachment.

united with the epithelium. It was not protected by the "free margin of the gum," but by the epithelial attachment. This area is not free; it is not exposed to the mouth.

ing hard and soft tissues. In Figure 32, we see, on the left side, calculus, leukocytes, degenerated epithelial cells and colonies of bacteria in the gingival crevice. And we know that bacterial plaques

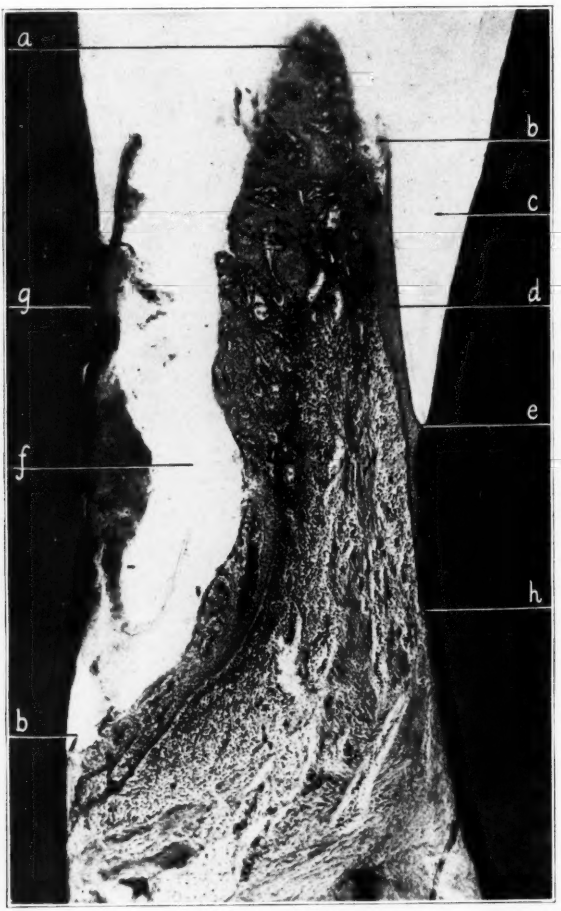


Fig. 32.—Interdental space between a second and third molar. *a*, free margin of the gum. *b*, bottom of the crevice. *c*, enamel. *d*, epithelial attachment. *e*, cemento-enamel junction. *f*, gingival crevice with calculus deposits (*g*). *h*, deepest point of the epithelial attachment.

Figures 32-34 are photomicrographs of specimens of teeth with their support-

lead to caries. Healthy gum tissue in itself is no protection against caries, but

healthy gum tissue usually signifies a shallow gingival crevice, and in shallow crevices not so much calculus can be deposited as in deeper crevices. Bacteria are constantly removed by the mouth fluids and food, by chewing, cleaning, etc., while deeper crevices offer the reverse of this condition because they cannot be kept clean. The proper prophylaxis should not be to place the gingival margins of fillings and crowns under the shallow crevices ideal, we cannot extend fillings under the free margin of the gum.

This is not intended as a treatise against the work of Black on extension for prevention. His work will always stand as one of the greatest landmarks in the advance of dentistry. His teachings on extension for prevention are authentic to this day, except in one respect,

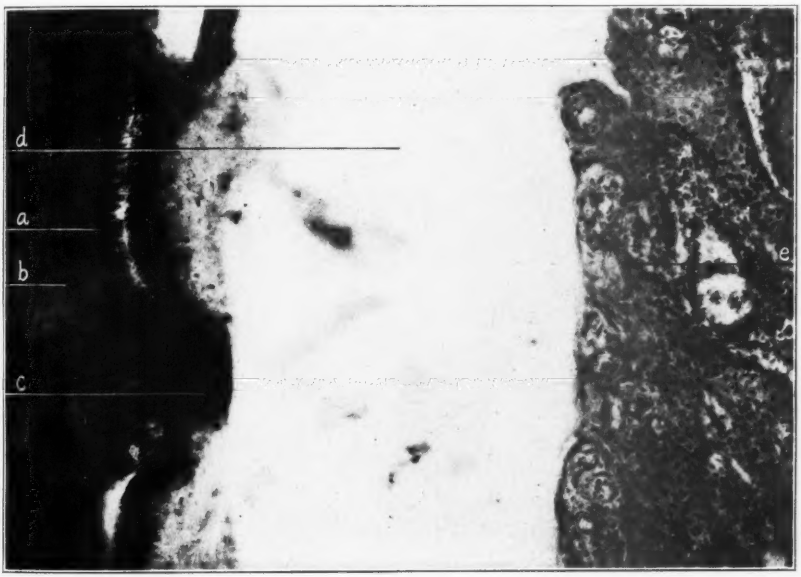


Fig. 33.—Higher magnification of *g*, Figure 32. Caries *a* of the dentin *b*. *c*, bacterial plaque. *d*, crevice. *e*, crevice epithelium.

free margin of the gum as a preventive measure, but rather to establish thorough mouth hygiene and maintain shallow crevices. Good methods of brushing the teeth and gums—a system of massaging, the use of toothpicks, etc.—will help us to maintain something to approximate the ideal gingival crevice. If we consider and that pertaining to the phase which has to do with the extension of cavities under the free margin of the gingiva. The observations of Gottlieb have shown us the true relationship between the gum tissue and the tooth structures. It was also he who first called our attention to the necessity for change on extension for

prevention.[23] It is necessary to correlate our clinical practices with histologic findings. We shall discuss the various phases in order.

1. That portion of the tooth which Black considered as protected against caries by the free gingiva is not the gingival crevice but the epithelial attachment. 2. The epithelial attachment and the surface of the tooth are grown together, and, at this place, the tooth is not exposed to the mouth. 3. The gingival crevice, to its deepest portion, is the dirtiest place in the mouth. It is filled with calculus, destroyed epithelial cells, leukocytes, bacterial plaques, etc. 4. The shallower the crevice, the smaller the likelihood of its being dirty, though some deposits are always present. The aim of prophylaxis should be to maintain shallow crevices and to keep them clean.

Fig. 34.—Bifurcation of a molar. *a*, bottom of the gingival crevice. *b*, calculus. *c*, gum margin. *d*, space due to shrinkage. *e*, subepithelial connective tissue with inflammatory infiltration.

In Figure 32, we see the interproximal

23. Gottlieb, Bernhard: Die Prinzipien der Stumpfpreparation, Ztschr. f. Stomatol, No. 7, 1924.

space between the upper left second and third molars of a human being. On the third molar, the bottom of the gingival crevice is on the enamel, the deepest point of the epithelial attachment on the surface of the cementum. On the second molar, the whole epithelial attachment is found nearer the apex; the whole attachment is found on the cementum, and a large part of the cementum is exposed. The epithelium has been destroyed by inflammation at many places, and pus cells have entered the crevice. Calculus and bacterial plaques cover the surface of the tooth in the crevice. A higher magnification (Fig. 33) shows that caries has invaded and partly destroyed the dentin. Here, we have caries in the gingival crevice. It is true that this is not a healthy gum tissue, but if it were healthy, there would be no crevice.

We do not mean that every deep crevice is pathologic, but the possibility for the deposition of calculus and bacteria is always greater in the deeper crevices, and it is then only a question of time until it becomes pathologic. Irritation from the calculus and bacterial toxins will result in pathologic change. Inflammatory reaction in the connective tissue will lead to hyperemia, growth of the connective tissue, emigration of blood cells and degeneration of the epithelium. Ulcers will develop, and pus will appear in the crevice, and we have the condition described as pyorrhea. Figure 34 is the bifurcation from a molar. The epithelial attachment has grown along the cementum. The bottom of the gingival crevice is at *a* on both sides. On the sides of the roots, calculus and bacterial plaques *b* are deposited. The space between the gum and the calculus is due to shrinkage during fixation. This space during life was entirely filled with gum tissue. We can clearly follow the outline of the gum by the contour of the deposits. In the bifurcation, caries has penetrated the dentin. Inflammation in the connective tissue and the condition of the epithelium indicate the tissue reaction to irritation.

These cases were presented in support of the contention that the gingival crevice is not a self-cleansing but always a dirty place.

Not only is the depth of the gingival crevice of significance in restorations in close proximity to the free margin of the gum, but the continuous shifting of the epithelial attachment apically is also very important. That the whole of the gum shifts apically has long been recognized. Black writes:

> In children the gingivae are long, covering a considerable part of the crowns of the teeth. As the child grows older, the gingivae become shorter and cover a less amount of the crowns of the teeth. As a person grows old, the gingivae disappear almost entirely so that practically the whole of the enamel of the teeth is exposed to view.

This clinical observation is excellent. We again call your attention to Figures 8 and 15-18 showing different stages of tooth eruption. Not the gum margin or the free gingivae, but the bottom of the gingival crevice and the epithelial attachment are important. Black's conclusions from his observations were:

> Therefore, if decays in this position (gum margin, Ref.) have begun in the child, they may be mid-length the crown when the child has arrived at adult age. Therefore the particular position of the beginning of these decays on the buccal surfaces will depend much on the age of the patient at the time of their beginning. They are, however, always near the free border of the gingivae at the time of their beginning. If such cavities are filled for young persons without pushing the gingivae well back in each case so that the border of the cavity can extend well under it, the natural shrinkage of the gingivae will soon expose the enamel between the gingivae and the filling. This will then be liable to decay again.

Here is the practical conclusion, and we see clearly where the mistake was made. We cannot push the gum back far enough to keep the fillings permanently under the gum. If the gum is healthy, as Black requires it to be for protection, the free gingiva is very short, and there is practically no crevice. If we force the gum away, we separate the epithelial attachment from the tooth, and by so doing, we injure and damage the supporting structures. Furthermore, in healthy conditions and with good hygienic care, the gum margin will immediately begin to shrink, and the gingival margin will be exposed. This is what happens in many cases with jacket crowns. If we prepare the tooth for a jacket crown as we are taught to do, we must remove the entire enamel. If we have a young patient, under 25 years of age, the epithelium normally is still attached to the enamel. (Stages I-II, Fig. 8.) If we were to remove the whole enamel, we should destroy the epithelial attachment, and the epithelium, following the laws of biology, would become attached low down on the cementum, and the gum margin, if no irritation were present, would shrink or recede, and again establish a normal shallow gingival crevice. As a result, the margin of the jacket crown would be exposed within a short time. It is not the injury of the gum margin or the irritation caused by poorly fitted jacket crown margins which causes the gum to recede. The injury or the irritation will result in just the opposite; i. e., an inflammation. Inflammation means swelling and tissue growth. Recession is shrinkage, atrophy, just the opposite of inflammation. In removing the whole enamel of the tooth to which the epithelium is still attached, recession of the gum margin follows. This recession results from the separation of the epithelium and the enamel, and finally the new attachment will be found under the cemento-enamel junction.

This point may very properly lead to the question: How is it that in the case of pyorrhea we have recession of the gum in spite of inflammation? In cases of pyorrhea, owing to irritation and inflammation the bottom of the gingival crevice, together with the epithelial attachment, shifts toward the apex, and more and more of the surface of the tooth becomes exposed in the mouth. The gum margin does not recede so long as the irritation is present. Not only does it remain in its original place, but it also becomes swollen or hypertrophic. The crevice becomes deeper, owing to separation of the epithelial attachment from the surface of the tooth, as long as the irritation and the inflammatory hypertrophy of the gum persists. This is the process of development of pyorrhea pockets. If for any reason the irritation subsides, the inflammation diminishes; the hypertrophy gives way to atrophy, and the gum margin recedes. That is why we see recession of the gum after successful treatment of cases of pyorrhea.

Very often we see recession of the gum without preceding inflammation. This is due to the natural downward growth of the epithelial attachment, as illustrated in Figure 8, Stages III and IV. This recession of the gum proceeds at different rates with different individuals. The slower the shifting of the epithelium along the root, the better the outlook for the tooth. Investigations have shown that the epithelium will, without exception, grow along the root sooner or later. This is true not only of human beings, but also of all animals which have teeth similar to those of man.

Black had also observed this. He wrote:

Even then, the best made filling is apt to be short-lived for the reason that a little more recession of the gum will allow decay to begin again root-wise of the filling.

Black considered the recession of the gum in every case a pathologic process, but Gottlieb's investigations have shown that a slow shifting of the epithelial attachment is a physiologic process.

With the physiologic shifting of the bottom of the gingival crevice apically, together with our knowledge of the epithelial attachment and gingival crevice, we have another reason for not extending restorations under the free margin of the gum. We must first of all differentiate between young and old persons. In this connection, by "young," we mean under 25 years, when no pathologic conditions are present, and as regards the relation between the bottom of the gingival crevice and the tooth, under 25 years of age the former is usually on the enamel. (Stages I and II.) If jacket or other crowns are to be made for these cases, it is not necessary that we remove the entire enamel. We remove only so much of the tooth as will allow the gingival margin of the restoration to be outside the free margin of the gum. It should be far enough away from the gum margin to be easily cleaned with a toothbrush, and easily polished when finished. Because of esthetics, it is frequently not desirable to leave the labial margin of the jacket crown outside the crevice. We should know why we extend the margins and be aware of the consequences. In young persons, we can always be sure of a rapid recession of the gums when the entire enamel is removed. We should avoid placing jacket or other full crowns in patients falling into groups I and II (Fig. 8) or else be prepared to remake and readjust the restorations from time to time to meet esthetic requirements.

This is also more or less true of all types of filling operations. The gingival margins of fillings should be left far enough outside the free margin of the gum to leave them out of the most susceptible areas of caries. This is especially true when cavities are prepared for various bridge abutments but otherwise sound teeth. They should end in areas where it is easy to keep them clean. Interproximal gingival extensions should be far enough beyond the contact point to render finishing and polishing easy. Of course, this often cannot be done, as, for instance, when the cavity is already extended under the margin of the gum by caries, or when the interproximal papillae reach well to the contact point.

In young persons who are highly susceptible to caries, extension gingivally cannot prevent decay. In addition to extension for prevention, Black considers anatomically correct restorations of tooth surfaces and contact points also as being of much importance. In older individuals, the susceptibility to caries is not so great, and proper hygienic care will minimize secondary decay. There is no good reason for extending crowns, inlays, etc., beneath the free margin of the gum. Everyone must concede that the gingival margins of fillings and crowns can be better finished if outside the gum margins. Crowns are not constructed to protect teeth against decay. No crown can be extended far enough gingivally to save a tooth indefinitely from decay. As the bottom of the gingival crevice passes the cemento-enamel junction, the cementum becomes exposed. This is usually the case in older persons. When a jacket crown is made for these cases, we are not required to extend the gingival margins beneath the gum. We prepare the tooth as far as the cemento-enamel junction for esthetic reasons; otherwise, we should

not have to remove the entire enamel even in these cases. Of course, it is always necessary to meet mechanical requirements in the preparation of teeth for fillings or crowns. Sometimes, extensions are made solely to meet these requirements. The principles of anatomy, biology, esthetics and mechanics must be considered in planning dental restorations.

A HISTORICAL SKETCH*

By ARTHUR D. BLACK, A.M., M.D., D.D.S., Sc.D., Chicago, Ill.

THE practice of dentistry, in one form or another, dates back to the time when teeth first began to decay. While our records cover but a few thousand years, we are constrained to believe that if Cain or Abel had a toothache, Adam had to do something for it. Professor Olmstead, archeologist, reporting on excavations about the biblical city of Nineveh, refers to tablets which record that a physician was called to task by the king because he had not cured him of an illness. The physician replied that if the king would carry out certain directions, his fever would leave him, and, after giving other instructions, stated that the pain in the king's head, in his back and in his limbs, came from his teeth and they must be extracted. The idea of focal infections and the relation of mouth conditions to the general health was evidently recognized then, about 600 B. C., or about 2,500 years ago.

We know something of the dentistry of the Egyptians, the Etruscans, the Greeks and the Romans, when it was practiced as a specialty of the healing art, by "physicians for the teeth." During the Middle Ages, dentistry suffered a serious setback from which it very slowly emerged with the dawning of more enlightened years. During this period, those who performed operations on the teeth were called dentators. There were barber dentists, as there were barber surgeons in those days. The first dental book of which we have knowledge was published anonymously in German in 1534, and the last chapter in this book is devoted to methods of treatment to prevent the falling out of the hair.

There was a splendid dental revival in France during the early part of the eighteenth century. The leader was Pierre Fouchard, who wrote a remarkable and wonderfully illustrated complete treatise on dentistry in 1728. This book describes the diseases of the gums and their treatment, the correction of irregularities of the teeth, appliances to be worn by persons having cleft palates, artificial sets of teeth that were enameled, the removal of decay and the filling of teeth, the treatment of abscessed teeth, methods of extracting, etc. The word "dentist" originated during this period.

The dentistry of France became very slowly established in our colonies. Those of this audience who are not dentists may be surprised to learn that Paul Revere practiced dentistry. May I read

*Address on the occasion of the dedication of the new building of Washington University Dental School, St. Louis, Feb. 22, 1929.

you his advertisement, copied from the *Boston Gazette* for Aug. 29, 1768.[1]

Whereas many Persons are so unfortunate as to lose their Fore-Teeth by Accident, and otherways, to their great Detriment, not only in Looks, but speaking both in Public and Private: This is to inform all such, that they may have them replaced with false Ones, that looks as well as the Natural, and answer the End of Speaking to all Intents, by Paul Revere, Goldsmith, near the Head of Dr. Clarke's Wharf, Boston.

The advertisement[2] of another Boston dentist, appearing in 1796, is of interest as it gives an idea of the dentistry of the time, this man apparently being one of the leading practitioners.

Josiah Flagg, Surgeon Dentist, Informs the Public, that he practices in all the branches, with improvements. Transplants both live and dead Teeth with greater conveniency, and gives less pain than heretofore practised in Europe or America; Sews up Hare Lips; Cures Ulcers; Extracts Teeth and stumps, or roots with care; Fastens those Teeth that are loose; and when thus put in order, and his directions followed (which are simple), he engages that the further care of a dentist will be wholly unnecessary; fixes Gold Roofs and Palates, and artificial teeth of any quality, without injury to and independent of the natural ones; a room for the practice with every accommodation at his house, where may be had Teeth and Gum Brushes, Mastics, etc.; also Chew-sticks, particularly useful in cleansing the fore Teeth and preserving a natural and beautiful whiteness; which Medicine and Chew-sticks are to be sold wholesale and retail, that they may be more extensively useful.

Dr. Flagg, has a method to furnish those Ladies and Gentlemen, or Children with artificial Teeth, Gold Gums, Roofs, or Palates, that are at a distance and cannot attend him personally. Cash given for handsome and Healthy Live Teeth, at No. 47, Newbury Street, Boston (1796).

The real development of dentistry in America began in 1839, with the establishment of the first dental college in Baltimore. Previous to that time, dentistry was a trade that might be acquired by apprenticeship, and there were many itinerants, who made the rounds from village to village as did the umbrella menders and the scissors grinders. Horace Hayden, a dentist of fine breeding and good education, an organizer of ability, petitioned the medical faculty of the University of Maryland to institute a course of lectures on dentistry. The medical faculty declined, and Hayden, assisted by Chapin A. Harris, established the Baltimore College of Dental Surgery. It was this action on the part of the University of Maryland that resulted in the development of dentistry as a separate profession. The practice of dentistry at that time was so generally considered a trade, in connection with which health relationships were not recognized, that one could hardly criticize the action of the medical school. It was the first emergence of dentistry from charlatanism, quackery and commercialism. However, in view of the fact that in all European countries dentistry has developed under medical control, it is not out of place to question whether American dentistry has not outstripped all other countries because of its independent development. This is not a criticism of our medical schools, but relates rather to the highly developed technical training which is a part of modern dental practice.

Other dental colleges were established; in Cincinnati in 1845, in Lexington, Ky., in 1850; in Philadelphia and Syracuse, N.Y., in 1852; two more in Philadelphia in 1856 and 1863, and one in New York City in 1866. Of these schools, three were discontinued, so that there were but five other dental colleges in existence when the Missouri Dental College, the forerunner of Washington University Dental School, was established in 1866.

1. Koch, C. R. E., History of Dental Surgery, Vol. I, p. 96.
2. Footnote 1, P. 92.

The other five were located, one in Baltimore, one in Cincinnati, two in Philadelphia and one in New York City.

In St. Louis, at that time, there lived what appear to me to have been the most wonderful group of men that ever practiced dentistry in a single city. Homer Judd, W. H. Eames, H. E. Peebles, W. N. Morrison, H. J. McKellops, Isaiah Forbes, A. M. Leslie and Edgar Park were among the leaders who organized this school. They were of such high standing that they became a center of influence for the advancement of dentistry in the Central West. A number of physicians appear to have been equally interested with the dentists in the success of the school. This group consisted of Charles W. Stevens, A. Litton, J. T. Hodgen, J. S. P. Alleyne, E. H. Gregory, Frank W. White, Charles A. Pope and J. B. Johnson.

I am especially pleased to be one of your guests on this occasion, for much of my life has been spent in what might be termed the spiritual atmosphere of this school. As a matter of fact, Northwestern University Dental School owes its establishment in large measure to the high idealism and outstanding achievements of the group who organized this school. Two of the founders of Northwestern, Thomas L. Gilmer and G. V. Black, as well as two others who put in many years of service, C. R. E. Koch and J. H. Prothero, all received their D.D.S. degrees from Missouri Dental College. It was the spirit of Judd and his associates that inspired those who organized Northwestern, and we are proud to believe that we continue to work in that atmosphere. One of our choice possessions is an oil portrait of Homer Judd.

It is appropriate that we should, on this occasion, turn to the Commencement address[3] delivered by Dr. Judd in 1871, fifty-eight years ago, and quote from it, because he there states the ideals of the group that organized the school:

> Under a charter of the State of Maryland, the Baltimore College of Dental Surgery was brought into existence, and took its stand among the literary and scientific institutions of the land, as the first regularly organized dental college the world had ever known. Dentists will ever look back with interest upon this eventful epoch, in which dental art burst its chrysalid form and stood revealed a living science. It was not born surrounded by the mysticism, the superstition, and the darkness of the world's early history, but came into existence in the fulness of the mid-day light of the nineteenth century. Untrammeled by the weight of hoary theories, and unfettered by the prejudices engendered by acrimonious disputations, it was fitted to appropriate to its own use whatever of art or science it found ready developed to minister to its necessities, and without stopping to mingle with the disputants of opposing dogmas, set itself vigorously to work in the direction of scientific progress.
>
> That there may be a still more rapid advancement in scientific attainments in the profession, arises the necessity for a more extended course of dental studies, and a more intimate knowledge of the fundamental principles of medicine, that all the sympathies, and physiological and pathological connections of the different organs of this wondrous work of nature may be fully appreciated and understood. The attention can scarcely dwell for a moment upon this proposition without the grand truth forcing itself upon the mind, that to be able to treat successfully and safely the various pathological conditions of the teeth and oral cavity, requires the same amount of general knowledge of medicine that is necessary for the success of the oculist, the aurist, the surgeon, or the practitioners of general medicine. In view of these facts, the practitioners of the West conceived the idea of establishing an institution of learning for dental students, where the fundamental principles of medical science should be recognized to the fullest extent, as the only proper foundation for a knowledge of scientific dentistry.

3. Judd, Homer: Missouri Dent. J., 3:81, 1871.

All improvements in dental practice, which have looked to a more extended conservatism of dental organs, are being more and more appreciated, and the immense advance made by the profession in the last few years is destined hereafter to exert no feeble influence in promoting and preserving the general health of communities, and thereby contributing to the general weal of man.

That is a program of the finest technical training, founded on a knowledge of the medical sciences, looking forward to the relations of the mouth to the general health and to the prevention of dental disease. Could it be better stated today?

The Missouri Dental College became a part of Washington University in 1892. At that time, but very few of our great universities had recognized the service value of dentistry by accepting the responsibility of establishing dental departments. In 1900, there were forty-two dental schools in the United States and Canada, of which only fifteen were departments of universities, the other twenty-seven being privately owned or more or less closely affiliated. In 1929, there are forty-four dental schools, of which forty are departments of universities and four are privately owned. Possibly nothing means more to the future of dentistry than the action of our universities in accepting the burden of dental education as one of their duties. It means that the education of each student will cost considerably more than he pays; also, that there will be developments in graduate training and research, all of which call for endowment for dental schools.

According to figures collected by the American Medical Association, gifts to medical education and research in the United States for the period from 1911 to 1920 amounted to about $65,000,000; from 1921 to 1925 to about $100,000,000, and for 1926, $109,000,000. Sufficiently accurate figures are not available for the past two years, but the amount for each year is considerably less than for 1926. We may safely say that more than $325,000,000 has been given to medical education in the past twenty years. During the same period, the total for dentistry has been about $8,000,000. Dentistry does not begrudge medicine any of its munificent financial support, but it is quite plain that the universities which have assumed the responsibility for the training of dentists must devote a generous share of their endowment income to dental departments until such time as special gifts may be obtained. It is the duty of dentistry to so impress its service on the public mind that gifts will be forthcoming.

The Code of Hippocrates established the high ideal of professionalism as differentiated from a trade. All that is good and worth while in medicine is built upon this oath, which can be summed up in the single word "service." The Century Dictionary defines a trade as a skilled or specialized handicraft, or a business carried on for profit. A profession is defined as a vocation that properly involves a liberal education and mental rather than manual labor. As we review the development of dental education during the past twenty-five years, we find a succession of additions to courses of study and to the preliminary educational requirements which have led some to complain of the time necessary to prepare one to enter practice. We may ask why there should be so much training in the sciences for the practice of medicine, and since our dental colleges are now in the process of extending their preliminary requirements, it may not be amiss to touch on this point. I could not do better than

to quote from a splendid address[4] delivered by Sir Robert Falconer, president of Toronto University, before the annual meeting of the Institute of Dental Teachers held in Montreal in 1922. In answer to the question, Why is the medical man trained in the premedical sciences, or even in the sciences which are not medical? he says:

> Partly that he may become acquainted with the organism with which he has to deal, and partly that he may be trained scientifically. The laboratory is used everywhere and his powers of observation are being made acute. It is not that he remembers all these things. He must, of course, remember the most outstanding things, but it is that he is being given a scientific attitude of mind. We know what a vast difference in interpretation is manifested by different men when they are asked to give an account of an ordinary happening—we get the most diverse accounts of what has taken place. The inaccuracies of observation are notorious. Certainly, success in medicine depends on accuracy of observation. And the training of the scientific mind is, partly at least, the training to see, to know what to look for and to be sure that you have found what is there. That is really the basis of diagnosis.

In dealing with an organism so complicated as the human being, we have not only to consider the physiologic or normal mechanism, and all of its pathologic derangements; we must also master, as far as we are able, the psychologic and personal sides, if we are to be successful in the highest degree. For success in practice is quite as often dependent on the proper diagnosis of the peculiarities of the individual as on an exact determination of the disease. To find the gate of entry to both the individuality and the physical derangement is the problem of the professional man. The physician or the dentist with the broadest knowledge, rightly applied, will be most successful.

4. Institute Dental Teachers Trans., 1922, p. 24.

As medicine and dentistry delve deeper into the field of prevention, the study of the psychologic and personal sides becomes more important, because the management of the patient must be carried to the point of conviction that it is best to consult the doctor at stated intervals while well, in order to keep well, and to be willing to pay for the advice received year after year. May we suggest that the present trend of medicine and dentistry toward prevention will be greatly augmented in the future by added successes in the management of diseases hitherto uncontrolled. Our idealistic aim should be to prevent disease so surely that there will be none left for us to treat. Practically, it is fully realized that we can hope, by the utmost endeavor, to do no more than reduce in small measure the incidence or severity of diseases in general; yet there are numerous examples of specific diseases which have been virtually eradicated.

Jenner's discovery of inoculation with the virus of cowpox to prevent smallpox gave us the first positive means of eradicating a disease which had taken its toll of many thousands of lives. The experiments of Reed, Lazear, Carroll and Argomonte in 1881 proved the mosquito (*stegomyia*) to be the intermediate host in yellow fever. Lazear lost his life in the experiment and Reed died soon afterwards, that the world might be freed of this scourge. It was the work of these men that made it possible for General Gorgas to prevent yellow fever in the Panama Canal Zone. Otherwise, General Goethals would probably have failed, as did the French, in the construction of our great interoceanic waterway.

The development of our knowledge of typhoid fever and of means of preventing this disease is an interesting example of the years of study often required to mas-

ter a disease. In 1837, Gerhard differentiated typhoid and typhus fever clinically; in 1880, Eberth isolated the typhoid bacillus; in 1896, Widal and Sicard introduced the agglutination test for typhoid, and, in 1902, Firth and Horrocks showed that flies and other insects could carry typhoid bacilli. The principal fight against typhoid for many years was an effort to prevent contamination of water and food by proper sanitation. More recently, the development of typhoid inoculation has given very nearly complete control of the disease.

In referring to the progress which might be made in the application of preventive measures, Charles H. Mayo called attention to the fact that the advance of the profession may often be delayed until the public is educated first to understand and then to demand preventive service. One of the advantages to humanity resulting from the World War has been the advancement of preventive medicine. Hundreds of thousands of soldiers had their first experience with preventive measures while in service, and these men have, consciously or unconsciously, spread the gospel of prevention as applied to typhoid and other diseases, and to certain phases of hygiene and sanitation, in such a way as to make the public more receptive to the ideas of prevention.

In this connection, attention is called to the fact that dentistry has made wonderful progress toward prevention in recent years from the very fact that large numbers of persons are coming every six months for examinations even though they know of nothing that requires attention. Our people are gradually coming to appreciate the fact that preventive dentistry is best, both as a safeguard of a healthy mouth and as a matter of economy. It is realized that definitely arranged periodic examinations and treatments tend to prevent chronic abscesses and pyorrhea, and thus protect the general health. Patients are coming to the dentist regularly, instead of, as formerly, delaying until an aching tooth, with an exposed pulp, has brought them in. It should be the foremost duty of every physician and dentist to teach the people the value of regular and thorough physical examinations—to prefer to pay the doctor to keep them well.

May we compare medical and dental education in one other respect, as we look a little into the future. In the early days, dentistry was practiced largely as a trade, and there was little realization of the need of medical education for a dentist. Today, no one should question the statement made by Dr. Judd in 1871 that the dentist needs the same basic education as the man practicing any other specialty of medicine. While great progress has been made, dentistry is still lacking in the most thorough training in the fundamentals of medicine, which should constitute its foundation. On the other hand, our dental colleges represent the highest development in schools designed to train men for the practice of one of the specialties of medicine. Our medical schools have held closely to the task of training men for general practice and have only recently assumed responsibility in the training of their graduates for the practice of the several specialties. Medicine must develop specialty schools comparable to dental colleges; while dentistry elaborates the medical fundamentals. Progress along both lines will eventually make the requirements for all specialties closely parallel.

We have gathered here today for the formal dedication of this building to the service of humanity. In its construction, equipment and appointments, it repre-

sents the finest that can be provided for the purpose, and will long stand as a monument to the members of the faculty who are responsible for its design. It gives to the faculty increased opportunity for thorough teaching and research, and to the students those facilities and accommodations which will make their studies and their training in fingerskill more engaging. It stands as a pledge on the part of the trustees of Washington University that it has accepted the responsibility to all communities which the alumni of this school serve that the preparation for that service will continue to be of the high character for which this university has always stood.

We rejoice in the continued existence in this school of a faculty which has the same high ideals as had its founders, and which is now, in this splendidly equipped building, girding itself for the achievements which will meet the needs of the future.

Permit me to congratulate the officers and members of the board of trustees, also the members of the faculties, the alumni, students and friends of Washington University on the dedication of this building. I especially felicitate Dean Bartlett and the members of the faculty, the alumni and students of the dental school. The location of this building on the campus as one of the medical group insures an atmosphere which promises much for the future. More intimate relations will result in better understanding, finer cooperation and greater progress toward the ideals of Homer Judd and his associates who organized this school.

Would that Judd, Eames, Peebles, Morrison, McKellops, Forbes, Leslie and the others of that group might be here today. What joy it would be to them. What realization of fruitfulness of the work which they began. Their spirit is here; it must be in the men of this faculty and those who have gone out from this School. To be true to them, we and those who follow must ever carry on.

A SURVEY OF PRESENT-DAY DENTISTRY*

By C. N. JOHNSON, D. D. S., Chicago, Ill.

I SHOULD like first to express my keen appreciation of the honor paid me by an invitation to appear before this society on the present occasion. Ever since I began to read dental literature the profession of New York has held in its ranks many men of outstanding ability. I recall in particular the names of some of the members of the Odontological Society of New York, which organization, I am told, was merged into the First District Society when the American Dental Association was reorganized. I recall vividly such names as Atkinson, Kingsley, Dwinelle, Northrup, Jarvie, Perry of blessed memory, and many others. (Speaking of the last two calls to my mind the fact that there have been three men whose names have ever repre-

*Read at the December Meeting for Better Dentistry of the First District Dental Society of New York, Dec. 3, 1928.

sented to me the highest type of professional manhood, and for some reason, I have always classed them together. These men were Jarvie and Perry, of New York, and our beloved Dr. Darby, of Philadelphia. Happily, Dr. Darby is still with us, and I am sure I express the sentiment of every one within the sound of my voice when I say that it is our fervent hope that we be permitted the privilege of having him with us for many happy years to come.)

It is such men as these who lend distinction to our calling, and place its reputation well up among the leading professions of the world. If we had more of them in our ranks, we should have less cause for the invidious comparisons which we sometimes hear between dentistry and the other learned callings.

These New York names that I have just mentioned stood in those days as synonymous with all that was distinguished and progressive in dentistry, and I shall never forget the wonderful impression they made on me as a student and young practitioner. I could go on down the line to the present day reciting the names of New York dentists who have made their impress on their profession, and who have contributed constructively to its literature, a task which would be to me most pleasant, but your program committee has assigned for my presentation the more intricate task of making a survey of present-day dentistry.

To make a survey of any profession, or even of any activity of life in these latter days, is a rather hazardous undertaking, for the reason that, after all, it is only one man's opinion, and then so many surveys have been made of every conceivable enterprise in life, some of which, with the best of intention on the part of those making the survey, have stressed the nonessentials and magnified the minutiae, overlooking almost completely the really significant things connected with the activity that they were surveying, that there has grown up among the thinking people of America a well-grounded distrust of the value of surveys, and almost a conviction that it is impossible, through that medium, to get an accurate conception of the truth regarding any of the outstanding enterprises of life. It is somewhat with surveys as it has elsewhere been said regarding statistics: about the only thing that you cannot prove by statistics is the truth.

Yet there may be at least a certain element of virtue in studying for a few moments some of the most apparent activities or tendencies of our profession, to see if, by any chance, we may thereby discover our limitations and thus acquire some hope of eliminating them. The most surely fatal thing in any profession is to assume an attitude of smug complacency, as if the limit of perfection or possibility had been reached. The most vivid instance of this attitude in my recollection occurred some years ago when an editor of one of our leading dental journals resigned his editorship and went into another calling on the ground that dentistry was written out, and there was nothing further that could profitably be said about it. There was left, in his estimation, no incentive to continue in a profession where there was no outlet for his talent, and so he went to raising alfalfa.

I have no means of knowing how much intellectual stimulus he got from raising alfalfa nor how successful he was; but I do know that since the day he made the remark that there was nothing further to be developed in dentistry, there have been more things of a constructive character evolved in our pro-

fession than had ever been known up to the time that he made his assertion. It is the height of folly to assume that all has been learned about any pursuit, particularly about a calling like dentistry, in which the development has been so pronounced and the promise for the future is so great.

In this connection, I am convinced that we are just on the verge of a much greater development in our profession than we have ever witnessed up to this time. In fact, I believe that the possibilities of the future—even the immediate future—are infinitely greater than any of us imagine today, and while I sometimes feel that we have gained only a ray of light here and there, I think that I can see just ahead a development in dentistry compared with which all our progress of the past seems very meager and inconsequential.

This does not mean that I wish in any way to minimize the importance of the service that dentistry has given to the people; and before I venture to predict anything about the future, it may be profitable to consider for a few moments some of the things that have been accomplished in the past. To say that dentistry has changed the countenances of the people of the civilized world is hardly an exaggeration. Time was, in the memory of those now living, when the rank and file of our citizens were going about with mouths almost hideous from lack of care, with decaying and broken snags exposed to view or with great open spaces where teeth have been lost and no effort made to replace them. Neglect of the teeth was the rule rather than the exception, and nothing was thought of the handicap to the individual of an unkempt and disfigured mouth.

While it cannot be claimed that conditions today are perfect, it must be admitted that a great change has occurred. In almost every walk of life, there is at least some attempt to make the mouth presentable. If the natural teeth are lost, a laudable effort is usually put forth to supply the deficiency by artificial means, and while the outstanding result of many of these attempts is the conspicuousness of their artificiality, most artificial teeth are preferable to no teeth at all, and the mouths of our citizens are not nearly so objectionable in appearance as they formerly were. In fact, as far as appearance is concerned, many of our skilled prosthetists of today are so expert and artistic in their taste that they can insert dentures that almost defy detection and that restore their wearers to a pleasing and natural expression of countenance. It is a personal pleasure for me to pay this tribute to our prosthetic specialists, because I have elsewhere taken occasion to call attention to what I considered a discrepancy in their work on the ground that it seemed to lack standardization, as far, at least, as it related to the manifest differences of opinion among the leaders in matters of articulation and construction. I yield to no man in my admiration of the achievements of our leading prosthetists, and I look forward with confidence to the time when their work will be so standardized that their advanced theories can be followed by the average practitioner and the benefit passed on to the majority of the people.

PULPLESS TEETH

It is probable that no adequate survey of dentistry can be made without reference once more to that perennial question of the pulpless tooth. I almost feel like apologizing for introducing the subject at this time in this presence, but I affirm to you that, at least in the middle west, this question is not settled, nor can it be set-

tled until there is manifest a broader view and a better vision on the part of certain members of the medical and dental professions. There is still apparent in some quarters an unfortunate tendency to minimize the importance of the natural teeth and to magnify the dangers of the pulpless tooth. We still see diagnoses made from roentgen-ray pictures of apical abscesses on teeth with living pulps, and we see teeth condemned as the cause of systemic trouble on the most cursory examination or on no examination at all, without the slightest attempt to search for other possible sources of the infection.

But conditions are not quite so bad as they were at one time. In 1922 I had the honor of appearing before a joint meeting of this society with the New York Academy of Medicine in a symposium on this subject, and in that paper, I took some rather pointed exception to the prevalent tendency of the time to charge the teeth with every known ailment, to the almost complete ignoring of other avenues of infection. I did not hesitate to arraign certain members of the medical profession, as well as certain dentists for their radicalism in extracting teeth, because, at that time, both professions were running somewhat wild on the subject. The paper was to appear in the *New York Medical World and Medical Record,* and I recall receiving a letter from the late Dr. Rhein, who was chairman of the program committee, shortly after the meeting suggesting that probably I might wish to revise the paper and make it somewhat less drastic before its appearance in print. Imagine a man with the force of conviction of M. L. Rhein thinking a paper was too drastic! It must have been rather severe, but I thought then, as I think now, that plainness of speech is necessary in considering this subject, and so the paper appeared without modification. The point that I make in this connection is this: I do not believe that this paper would be considered drastic today if presented to an audience of physicians and dentists, and I therefore feel that we are taking a saner view of this question than we were half a decade ago. My only reason for introducing the subject now is because of my conviction that it is not well for us to cease agitating it till those in our profession who have been carried off their balance are brought back to reason, and till those in the medical profession who have been passing judgment on a subject with which they are not familiar shall be induced to refer matters concerning the teeth to members of the dental profession, who are working with them and studying them all the while, and who are thus better equipped to pass judgment on them than those whose familiarity with them is merely incidental, and whose chief interest in them is to use them as a handy medium on which to place the responsibility for every ill which cannot otherwise be readily labelled.

I must not discuss this further except to say that some of our research workers in recent times are bringing to light the possibilities of recovery in pulpless teeth even where disease at their roots has gained considerable headway. When given even a fighting chance, nature will repair damage around the teeth that has been caused by neglect, as it will elsewhere in the body, a fact amply demonstrated by Coolidge and by Boulger in the September number of THE JOURNAL. If we will devote a little more time to the care and preservation of the natural teeth, even though we also continue to study the insertion of artificial substistutes, we shall be rendering a better, even if less spectacular, service to our patients, and the occasion need never be

considered inappropriate to have this fact strongly emphasized.

In passing, it may be mentioned that the agitation concerning pulpless teeth has done much good in the way of inducing men to clean up infection in the mouths of their patients, even though, in too many instances, what has been accomplished through the sacrifice of the teeth should have been done through the medium of proper treatment and preservation of the teeth. It requires a long time to find our balance when once it has been lost.

SPECIALIZATION

A survey of dentistry today could not be made without some consideration of the subject of specialization in our profession. Of the necessity for specialization, there can be no question. It has been the means of advancing dentistry to a degree that never would have been approached without it, and we are indebted to it in many ways. Therefore, with all of its limitations, it is here to stay, and it must be reckoned with. Much has been said about the narrowing tendency in specialization—about the fact that a man loses breadth of vision when he concentrates all the while on one avenue of effort. This has been discussed so fully that it is unnecessary to refer to it here, but there is one phase of specialization that requires careful consideration at this time. I disclaim any ability to suggest a remedy for the condition to which I am about to refer, but the thing that is uppermost in my mind in connection with this question is the increased cost of dental service to the people as the direct result of specialization. There is no question that, while the people are undoubtedly as a rule being better served through specialization, they are paying much more for it, and they are paying in some cases so much more that the relation between the improved service and the increased cost is hardly equitable. Conditions have been such in recent years in America that the situation has not become sufficiently acute to demand for it concrete consideration. With rare exceptions, economic conditions in this country have been unusually favorable, and to speak without any equivocation, a wave of extravagance has swept over the land that even a great presidential election has hardly been able to check; and in times like these, with earnings high in all lines, the pinch of necessity has not forced people to economize as they have in the past, and they pay willingly what at other times they would complain of as exorbitant fees.

We may use the argument which we all consider logical that the professions are not any too well paid at best, and that no fee need be considered too high for dental service, if it is well and skillfully performed. This argument seems to be fundamental; but in common with many other fundamental questions, it has more than one side to it, and the other side of this question is the impression being made on the people by the increasing cost of professional service. This impression has taken tangible form in the organization of a national committee on the cost of medical care, and a five-year tentative program has been laid out to study this matter in all of its bearings. It is not the contention of the committee that professional men are paid too much for their services as a rule, but the fact remains that it is costing the people too much to be ill. Somewhere, there must be a solution of the problem, though the committee does not promise that it will find a solution.

It may or may not be considered significant that, in the prospectus sent out

by the committee outlining their proposed study, an illustration was used at the very beginning of a man, on having been ordered by his physician to have his teeth cared for to hasten his recovery from an illness, answering that he could not afford to have the work done owing to hospital and other expenses incident to his illness. The man had saved quite a snug sum before sickness entered his family, but this was soon used up in what seem to be considered at the present time the necessary expenses which go with the experience of being sick.

If such conditions exist today in the midst of economic prosperity, it is pertinent to ask what will happen in the event of a stringency such as comes to any country at one time or another. A general conviction on the part of the people in times of stress that professional fees are unjustly excessive can result in only one thing: a refusal, as far as possible, to have professional service performed. This we all know would be not only a hardship on the profession, but also a definite detriment to the people. Therefore, it behooves us to study somewhat carefully the economic relationship between the people and the profession, and to strive in every way possible to maintain an equitable adjustment of compensation that will be acceptable to all. To the degree, then, that specialization increases the cost of dental service, it must be reckoned with, because, in the end, the people must have the benefits of specialization and they must have them at a cost that is not prohibitive. The economic genius who can work out this problem so that it is mutually satisfactory will receive the thanks of the people and the profession.

THE AMERICAN DENTAL ASSOCIATION

One of the chief agencies in the advance of the profession is to be found in our dental societies, and of all of them the American Dental Association is, of course, outstanding. Every member of organized dentistry should take an interest in this Association and should study its needs and be able to make suggestions for its improvement. It is exerting an influence today that cannot be comprehended except by those who are intimately connected with its various activities, and it is a matter of the greatest moment that its influence shall always be directed along such lines that the result will redound to the benefit of the profession and the people, and to the credit of the organization.

Even if it were possible, it would be inappropriate on this occasion to go into its various activities, but there are several things that may advisedly be discussed wherever any of its component societies meet. At this particular season of the year, the distribution of Christmas seals for the Relief Fund would seem a very happy topic for consideration. Each year these seals are mailed to the members, and the aggregate sum raised largely through this agency has now assumed such proportions that the interest has been contributing to the support of a number of our needy members. At various times, thirty-five have received help from the fund, and, at present, there are nineteen being aided. Of the thirty-five, there have been ten who have had their aid renewed twice, three who have had it renewed four times, and six who have had it renewed three times. It is a very tangible aid that is coming to our members from the relief fund. As time passes and a larger relative number of our numbers grow old, the need for relief will increase, and it is important that we build up this fund as rapidly as possible to be able to care for the approaching demands. If all of our members could see

some of the letters that are received as the result of the aid being given our needy members, the response to the distribution of the seals would be one hundred per cent. All honor to the men who first suggested the establishment of such a fund, and all honor to the many splendid men of today who are making the fund effective through their contributions.

A new activity of the American Dental Association that has just been inaugurated deserves special mention at this time. A department has been organized known as the Bureau of Chemistry, through which investigation is to be made of the various products that are being offered to the profession and the people in the way of mouth preparations of all kinds; the idea being to learn their ingredients, their efficiency and their legitimate cost, to the end that the people be not imposed on by spurious or harmful products or by exorbitant prices for worthless preparations. There is no intent to injure or embarrass any worthy or honest manufacturer, but merely to search for facts in a legitimate protection of the public and the profession.

This activity is approached with a full knowledge of the manifold difficulties associated with it, and it is hoped that the profession will take a vital interest in it and aid in every way possible in an earnest effort to ascertain the truth and nothing but the truth about the various preparations and materials that are being offered for sale at the present time. The A. D. A. chemist is located in the research laboratory of the American Medical Association, the facilities of which have been kindly placed at his disposal, a courtesy that is much appreciated by the American Dental Association. As you all doubtless know, the findings of our chemist are to appear monthly in THE JOURNAL, and if the succeeding reports create an interest equal to that aroused by those that have already appeared, it is evident that no activity of our Association has ever been of greater significance than this. The Bureau is under the supervision of our Secretary, Harry B. Pinney, which is an assurance that it will be efficiently conducted.

OUR STATE SOCIETIES

If the American Dental Association is to function to its full capacity, it must keep in the closest possible touch with the various state societies which form its components. The component is, after all, the very life of the parent body, and each is an important complement to the other. Therefore, the state officers' conference that is held in January of each year is a most important factor in cementing the interests of both bodies, and is of the greatest value to every one who attends. Through this medium, the needs of the state societies, and of the organization itself, are better understood by all, and the result is more efficient teamwork.

When the great distances in this country are considered, it is a tribute to the dental profession to find an association of this size with the cohesion and loyalty evidenced by its members. The attendance at its annual meetings surpasses by far the relative attendance of any other national organization on the continent, and this is all the more creditable when the sacrifice that must be made by many of its members is considered. The future of the Association seems very secure, and yet it must be remembered that, for the maintenance and growth of an organization like this, it is insistently essential that there be unselfish devotion to its best interests on the part of its members and an elimination of the ulterior motive and the itch for personal aggrandize-

ment that seems to intrude itself in every human organization, and from which our own beloved Association has not been altogether free. The most perilous time in the history of every enterprise of life arises when it is riding on the crest of the highest wave of apparent success; and while we may well congratulate ourselves on the achievements of the past there remains the insistent necessity for safeguarding in every possible way the stability of the future. And this can be done only by greater devotion to the best interests of the body as a whole, and the subjection of that greatest enemy of all organizations, personal ambition.

ENDOWMENTS FOR DENTISTRY

There is one outstanding need in dentistry today which must be apparent to every one. It has become the very laudable custom of some of our men of wealth to provide endowments for the promotion of human welfare in nearly every walk of life, and the money thus provided is doing great good in the world. The profession of medicine has profited greatly through these endowments. Within the last decade, more than $200,000,000 has been donated for medical research and education, every dollar of which may be made to revert to the betterment of the people of the world through improved medical service. It is most encouraging when the money gained by the genius of legitimate commercial pursuits is devoted to the alleviation of human suffering through the medium of a better knowledge of the cause and progress of disease and a deeper search into the problem of preventing it. All honor to the men who are today furnishing the means whereby our research workers in medicine are solving some of the problems that have baffled the men of previous ages. It is through the medium of research that certain devastating diseases of the past are no longer a menace to humanity, and we can only hope that the good work may go on till the appalling toll of human life taken through preventable disease may become only a memory in the minds of men.

But in the midst of all this achievement, what shall be given as the reason that dentistry has been so completely overlooked in the distribution of research funds? With the exception of the Forsyth and Eastman philanthropies, and the donations of Mr. Julius Rosenwald, of Mrs. Carter, of Honolulu, and of others, to the care of children's teeth in certain localities, and the study made by the Carnegie Foundation on Dental Education, no outstanding contribution has ever been made to the cause of dentistry. The primary object of the philanthropies just mentioned has been the concrete care of the teeth of children, most of whom, without this provision, would have had to go without care, and there can be no question of the worthiness or the worthwhileness of such a movement. But what is most needed today in the broader effort to learn the cause of dental disease and to discover the means of preventing is an endowment for research and education along the same lines as the endowments made to medicine.

If some of our great foundations could only be made to see the crying need at our very doors of solving some of our dental problems as they relate to the health of the people, there can be no question that endowments would be forthcoming. Dentistry has, for a sufficient time, struggled along on its own resources, fighting an uphill contest with disease, and all the while hampered by lack of resources within its ranks. The money that is being dispensed annually by the Research Commission of the American Dental As-

sociation is merely the expression of a noble impulse to do something for dentistry and the people on the part of the profession itself, but its efforts are too widely diffused and the units too far apart to work in harmony on any of our problems and bring them to a solution. In other words, with the best intent on the part of the commission and the various research workers who are operating under its grants, there is lack of cohesion in their efforts and a consequent wastage of energy and money without commensurate results. This is not the fault of any man or set of men: it is the inherent weakness of our plan.

What we need in dentistry is a different method of attack on disease, an attack backed by resources outside our societies, and directed by whole-time research workers with a program of years ahead of them and their future made secure by adequate endowments, so that they may work unhampered by the haunting dread of losing their position through the ever-present exigencies of our modern life. We shall never reach the ultimate of our possibilities in the way of research or education till the same kind of help is meted out to our profession that is so generously and appropriately dispensed to medicine; and the attention of our great foundations should be called to this fact on every occasion and through every medium. Surely dentistry has done enough for mankind, even with all of its handicaps, to entitle it to consideration as an integral part of the great health movements of the day, and as soon as our philanthropists are made thoroughly familiar with the facts, there is no question that adequate aid for research will come to it.

PREVENTION

No survey of dentistry can be made today without recognition of the crying need of prevention; or without observing, on the horizon of the immediate future, some very splendid efforts in this direction. Prevention, as has frequently been said, is the keynote of the hour, and this problem is being studied today as never before. It is true that our gestures toward prevention are somewhat pathetic owing to the fact that we know so little about the significant factor in dental disease, and yet it is a hopeful sign that today we are beginning to recognize the futility of going on forever repairing the damage that has been done without in any way directing our efforts toward the problem of preventing this damage.

It is encouraging to note that there are an increasing number in the profession who are not content with merely filling teeth and inserting dentures as a routine measure, and letting it go at that. More and more, the question is being asked as to how we can prevent so much of this trouble, and while the answer is not yet adequate, we can at least say that we are gaining a little ray of light here and there, which we hope will eventually spread into an illumination showing the way to the multitudes of the future and enabling them to accomplish something that up to this time has been denied to us. With the desire for prevention looming so large on the horizon just ahead of us, it may be profitable for us to consider for a moment the most approved methods of prevention at the present time.

First, of course, must be considered the question of a proper diet, and I am glad to mention this for the reason that I have been quoted as minimizing the factor of diet. I have never minimized the value of diet, because I am a believer in correct diet; but I have said, and I again repeat, that when our dieticians agree among themselves on a suitable

diet, which they have not done up to this time, we can more intelligently inform our patients regarding the matter, and not only this: the practitioner who has not made a careful study of diet has no right to prescribe a diet in any given case without an intimate knowledge of the peculiar idiosyncrasies of his patient, or in ignorance of any possible affection from which the patient may be suffering. In a general way, the regulation of the diet should be left largely in the hands of the family physician, who is supposedly better informed on the particular needs of the patient than is the dentist, although it is unquestionably true that, in some instances the dentist has made a more intimate study of diet as it relates to the teeth than has the physician, and his judgment under these circumstances should be considered. After all, the best results are usually obtained by a consultation between the physician and the dentist, and when this is entered into by both, in the proper spirit of cooperation, the welfare of the patient is best safeguarded. We need to know more about diet, and we should look forward with much anticipation to the final outcome of the studies now being made in this interesting field. Therefore, I have felt, and I now feel, that the rank and file of the profession cannot rely on their present knowledge of diet as the sole sheet anchor for the prevention of dental disease in their patients, and while we should advise a sane diet as best we may, we should seek for other means of controlling the tendency to decay of the teeth and the diseases of their supporting structures.

Happily we have at our command the means whereby we may accomplish this in large measure through the medium of close clinical attention by the dentist, and cooperation by the patient in the daily care of the teeth. It is unnecessary before this audience to outline the treatment that should be given children with the object of bringing about an immunity early in life, but that this can be done as a routine practice, there is no question. It has been demonstrated in numberless cases, and therefore the promise is logical, that if a child is given the proper attention, immunity will be established in the mouth, and the teeth preserved without the loss of a pulp to adult life. In every case, where this is done, it is the final answer to the question of the pulpless tooth. In family after family, the children have been brought with excellent teeth to an age where their parents had lost many of theirs, and if this is kept up generation after generation, we shall soon have a generation with no tendency to decay at all.

This is the vision of the future, and how near in the future it may materialize depends largely on two things: an intelligent grasp of the situation on the part of dentists and proper cooperation on the part of patients. To gain this cooperation, the people must be educated to its necessity; and, therefore, the significant factors in meeting the issue are devotion to duty by the profession and education of the people.

ARRANGEMENT OF TEETH IN ARTIFICIAL DENTURES IN ACCORDANCE WITH ACCEPTED LAWS OF ARTICULATION*

By R. O. SCHLOSSER, D.D.S., Chicago, Ill.

TO justify the use of the title "Arrangement of Teeth in Artificial Dentures in Accordance with Accepted Laws of Articulation," I deem it fitting to define the word law: "A rule of action, established by authority or custom; a rule of science or art, a scientific statement of the action and relation of things in nature, etc., observed to be always the same under given conditions."

Within the past fifteen years, many new ideas have been promulgated and a resultant large number of methods and technics have been advocated in the preparation of the mouth, the taking of impressions, the choice of occluding frames or the setting of the teeth.

One would naturally expect that in consequence, the work of the profession in this field would show a marked improvement and that, in certain exceptional cases, this is true cannot be denied; yet if we were to consider the value of the time spent by members of the profession generally in graduate and postgraduate courses, together with what they have spent for instruction and for the purchase of additional equipment, and then make a comparative study of the work that they did prior to and have done since they took these courses, from a standpoint of service value to their patients, certain questions might easily arise:

1. How much real progress has the profession as a whole made during the past fifteen years in the construction of artificial dentures?

2. To what may we ascribe the many failures of today?

3. Can the use of any special material or equipment insure us against failure?

4. Are we to refer all our edentulous patients to the specialist in prosthodontia?

5. Shall we continue to delegate the making of dentures to the commercial laboratories, and if so, can we honestly expect them to make satisfactory dentures from bad impressions and indifferently prepared contour restorations and false registration of the positional relation of the denture bases?

It is not difficult to formulate these questions and many others of a similar nature. It is quite a different matter to find answers to them. I would venture to make but a single statement regarding these questions: Owing to the lack of a thorough training in the elementary or general sciences, the average dental student, during his preliminary or predental educational period, has not become sufficiently conversant with the simpler though basic principles underlying all scientific effort or achievement, and therefore, in spite of the desire of the

* Read at the Meeting for Better Dentistry, of the First District Dental Society of the State of New York, Dec. 6, 1927.

dental faculties to assist him in overcoming this handicap, he has groped about with a limited vision in a field many sections of which will ever remain unfamiliar to him. After graduation, he has, in an empiric sort of fashion, added to his store of knowledge, and many times, because of his very limitations, he has come forth as an originator of new ideas of practice and procedure. Often he has had but a vague conception of the responsibility his state has placed on him when he was granted a license to practice his profession.

In 1884, Dr. Bonwill presented a paper before the Odontological Society of Pennsylvania, entitled "Geometrical and Mechanical Laws of Articulation." Since then, we have had the works of Snow and Gysi, both of whom presented systematic procedures of outstanding merit dealing with the occlusion and articulation of artificial teeth. Also, though in another field of dentistry, we should not fail to mention the work of G. V. Black on comparative dental anatomy, in which he often made special reference to articulation. Within the last ten or twelve years, we have had, one might say, a profusion of empiricists who presented what might be called cults rather than systems. A somewhat singular exception to the group last mentioned is R. L. Hanau. His entrance into the field of full denture prosthesis was in itself a rather unique one. Consulted by orthodontists for aid in the engineering phases of their problems, he worked with them and, during the years 1915 to 1920, read papers before their organizations. In 1920, he was a guest at the meeting of the National Society of Denture Prosthetists. His interest in the intricacies of full denture prosthesis was aroused, and since that time he has appeared as essayist and clinician at meetings of district, state and national organizations. He has been elected to associate membership in the National Society of Denture Prosthetists and in 1925 was elected an associate member of the Section on Full Denture Prosthesis of the American Dental Association. He is now on the faculty of the University of Buffalo School of Dentistry.

In his paper "The Laws of Articulation," Mr. Hanau has made a distinct contribution to denture prothesis; its value is only beginning to be realized. The laws are not laws of Hanau, but the laws of basic science concisely formulated and applied, and through application they have been checked by him and those who have aided him in his researches during the past six or seven years, dealing with the problems involved in full denture construction.

This paper will treat these laws of articulation as formulated by Hanau and graphically portrayed in his articulation quint. Other procedures which, in fundamental principle, have been the subject of practice for many years will, of necessity, be mentioned as occasion arises.

It is practically an impossibility to launch into a technical discussion of occlusion and articulation without some reference to the steps preceding tooth arrangement. In brief, these can be summarized as follows: case history, diagnosis, preliminary impressions, prognosis, tooth selection, study casts, preparation of individual trays for test impressions, taking of test impressions, making of casts and temporary or preferably permanent baseplates with attached occlusion contour rims and the registration of the positional relations of the baseplate contour rims while resting on the supporting tissues of the edentulous jaws. In addition, there is the proper transfer of the baseplates to an occluding frame

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or articulator. The latter is selected because it will permit the operator to subject the baseplates, when correctly mounted thereon, to undergo movements that shall, for the purpose of and during the setting of the teeth, be equivalent to the movements that they will undergo in relation to each other when placed in the patient's mouth. All these steps must first have been carried out with due care and precision if the setting of the teeth is to be carried out successfully.

It would be well at this stage to state or restate, with some degree of emphasis, the aims sought in the construction of full artificial dentures. First, artificial dentures should restore the lost structural supports to aid in restoring facial expression. Secondly, they are to function as aids to correct phonation. Thirdly, they are to replace the lost organs of the mechanism of mastication, and lastly they should not cause discomfort, physical or mental, to the wearer. We must at no time lose sight of or forget our ultimate purpose: to render truly professional service in the work which we have undertaken.

It is therefore assumed that by the proper performance of the steps previously mentioned, we have two well fitting baseplates with properly contoured occlusal rims, mounted on some type of adjustable articulator, that the bite opening registered has been checked and found acceptable, that the positions for the median line and the incisal edges of the maxillary anterior teeth, along with an acceptable overjet has been determined, and it is also preferred that the maxillary anterior teeth have been tentatively set and checked for harmony of size, form, color and arrangement. Further, an adjustable articulator having been chosen, it is assumed that the articulator equivalents of condyle guidance have been properly adjusted and that adjustment checked by the use of articulator check records. When all these things have been done and then only are we ready to begin the setting of the teeth in occlusion and articulation. The following definitions of these terms are descriptive: Occlusion of the teeth is a passive contact, while articulation is an active contact. The latter is by some referred to as functional occlusion.

By way of introducing a brief résumé of the "Laws of Articulation" I have appended to this paper a copy of the brochure "The Articulation Quint," by Hanau. The following are quotations taken from the quint:

The Articulation Quint is a graph coordinating the five main factors incorporated in the main laws of articulation and governing the establishment of *balanced* articulation.

The Quint indicates the influence of two single factors upon each other, while the three remaining factors are not changed. The five main factors are:

(1) The inclination of the condylar guidance.
(2) The prominence of the compensating curve.
(3) The inclination of the plane of orientation.
(4) The inclination of the incisal guidance.
(5) The heights of the cusps.

THE TEN MAIN LAWS OF ARTICULATION

1. An increase of the inclination of the condylar guidance increases the prominence of the compensating curve.

2. An increase of the inclination of the condylar guidance increases the inclination of the plane of orientation.

3. An increase of the inclination of the condylar guidance decreases the inclination of the incisal guidance.

4. An increase of the inclination of the condylar guidance increases the heights of the cusps, *progressively towards the posterior.*

5. An increase of the prominence of the compensating curve decreases the inclination of the plane of orientation.

6. An increase of the prominence of the compensating curve increases the inclination of the incisal guidance.

7. An increase of the prominence of the compensating curve decreases the heights of the cusps, *progressively towards the posterior.*

8. An increase of the inclination of the plane of orientation increases the inclination of the incisal guidance.

9. An increase of the inclination of the plane of orientation decreases the heights of the cusps, *equally, or nearly so.*

10. An increase of the inclination of the incisal guidance increases the heights of the cusps, *progressively towards the anterior.*

The arrangement of the teeth in accordance with these laws follows. The previous setting of the maxillary teeth is reviewed and checked and the necessary changes are made. In the main, these teeth are depended on as contour supports for the upper lip and in part also for the lower lip. They form the anterior segment of the arch and their position gives them greatest prominence. Therefore, due care should be taken in bringing out such details in their setting as will produce maximum harmony, namely, depressions and eminences affected by proper axial alinement. These in turn will bring out the high lights and shadows. For individual detail, the central incisors are set so as to converge slightly toward the sagittal plane. Labiolingually, they are depressed slightly at the cervical portion. The lateral incisors converge more severely and are also more depressed at the cervix, their incisal edges being elevated about 1 mm. above the position of the edges of the central incisors. This affords the needed clearance for the mandibular teeth in lateral excursions and also adds character to the arrangement. The cuspids may be compared to pillars of greatest eminence. Their axes converge least from the perpendicular. Their points are at first placed at about the same elevation as the edges of the central incisors. This, however, is subject to later modification as may be required.

In the arch formation, the mesial half of the cuspids should be in alinement with the central and the lateral incisors, while the distal half should be in alinement with the bicuspids and molars. The developmental ridge between the halves should be considered the dividing line between the labial and buccal convexities.

As previously stated, there is a distinct advantage in checking the selection and arrangement of these teeth before proceeding farther. If changes are necessary, they can be most easily made at this time.

SETTING THE MANDIBULAR ANTERIORS

The condyle indications are noted as is also the overjet of the maxillary teeth beyond the labial convexity of the mandibular rim. The position of the incisor pin is recorded as this will maintain the bite opening after the contour occlusion rims are removed. The latter step is now performed and we are ready to begin the setting of the mandibular anterior teeth. We make our first application of the laws as given in the quint. If the inclination of the condyle guidance as noted was steep, the inclination of the incisal guidance is set to be correspondingly flat. A small piece of soft carding wax is molded against the baseplate over the center of the mandibular ridge; the cuspids are set tentatively into this wax; the articulator jaws are brought into working bite lateral relations, and the teeth are so adjusted that, in this relation, they will occlude with the distal aspect of the maxillary lateral incisor and the mesial facet of the cuspids. Into the space remaining, the mandibular lateral and central incisors are to be set. It is at this stage that difficulty is quite often encountered. The ridge relation plus the accepted overjet as developed in the contour rims presents a

marked contraction of the mandibular arch, the space being cut down mesiodistally between the cuspids. This is but the residual evidence of crowding or irregular alinement of the lost natural teeth, and must in some degree be reproduced in the setting of the artificial teeth. To cope with this sort of situation and effect an arrangement that will in every sense comply with the laws of esthetics and phonetics and not run counter to the laws of articulation, I resort to various alternatives. The first is a separation of the maxillary anterior teeth, none over 0.5 mm. in width. This may be accomplished by a slight expansion of the arch, or if expansion is contraindicated, by moving the cuspids distally 1.25 mm., the lateral incisors, 0.75 mm. and the central incisors each 0.25 mm. This amount of space will not affect the acoustics appreciably and will give 2.5 mm. additional space for the mandibular teeth.

The second alternative is to set the latter teeth somewhat irregularly. The third is to grind the lateral incisors and cuspids at their mesiolingual contact points. This permits of closer lapping against the distal side of the central and lateral incisors. The fourth is to leave out one of the central incisors. This is most often resorted to in cases of extreme class 2 ridge relations, which are usually accompanied by unusual thickness of the lips. The fifth is to decrease the overjet slightly by expanding the mandibular arch. The sixth and least desirable is to substitute teeth of lesser dimensions. Lastly, some combination of the foregoing may be worked out.

When it has been decided what modification will best suit the individual case, the amount of overbite is determined in relation to the overjet, and to the inclination of the condyle guidance and of the incisal guidance. The latter is modified if need be to furnish proper freedom for the mandibular teeth in mandibular excursions. The teeth are now reset in the harder pink wax. The articulation of the cuspids worked out in the foregoing manner is looked on as the key to good articulation of all the teeth. Three separate yet coordinating articulator guiding surfaces for the control of the movements of the jaw members of the instrument having thus been accepted and established, and the mandibular movements having been simulated during the setting of the teeth, the necessary curves are automatically developed during the procedure as far as described. This will also be true of the setting-up of the posterior teeth.

The proper setting of the mandibular anterior teeth is the most difficult and, many times, the most trying part of the laboratory procedure in full denture construction.

THE TENTATIVE SETTING OF THE POSTERIOR TEETH

The setting of the anterior teeth having been completed, it is advisable to fuse the wax firmly to the teeth and to add sufficient wax to permit of festooning. Even at this time, the wax should be trimmed neatly about the necks of the teeth. A survey is made of the work thus far accomplished and of the factors involved in the further procedure.

We now note ridge relation as portrayed in the bicuspid-molar regions. The inclination denotes the plane of orientation, the plane we visualize as the one upon which we must bring the teeth into occlusion if the end-result is to be balanced articulation. (At this time, it is rather late to think of modifying the ridge relation surgically. I have never been an advocate of radical methods.) We now make further application of the

laws of articulation. A dipping down toward the posterior of the plane of orientation calls for an increase of the compensating curve. We check back on the inclination of the condyle guidance; we note the height of the cusps of the teeth in hand, and we set out to develop such curves as will coordinate with the mandibular movements as simulated with the aid of the instrument, so that when the instrument registers right or left lateral, straight or intermediate protrusion, we shall have the necessary tooth contacts.

Again we use some of the soft carding wax to facilitate a tentative setting. First, we place the wax over the center of the lower ridge and place therein the mandibular teeth. In placing the teeth at this time, we leave them connected by the wire as we get them from the dealer, place them so that the buccal cusps are centered over the ridge and incline them somewhat to the lingual aspect. We work out the anteroposterior curve approximately and then place the maxillary teeth in the wax and arrange them to conform with the arch curvature. Next, we close the articulator and adjust the teeth to centric occlusion. We then move to the right and left lateral and to the straight protrusive position and modify the arrangement until, by proper anteroposterior and lateral curves, the necessary contacts and clearances are developed. The use of the soft wax facilitates adjustment and permits the operator to check the suitability of the teeth and to detect interference in the vulcanite or other type of base. A bit of study will aid him in deciding whether to select other teeth or will show him how he can eliminate interference. Seeing the possibilities in the tentative arrangement simplifies the permanent setting.

PERMANENT SETTING OF THE POSTERIOR TEETH

The teeth and the black wax are removed from the baseplates. Beginning with the mandibular first bicuspid, each tooth is fitted with a small cone of softened pink wax, and the base of the cone is softened in the flame and the tooth placed. The lower first bicuspid is placed so that its mesioproximal angle is in contact and alined with the distal side of the mandibular cuspid. The arch form as well as the curves are dependent on correct approximal alinement. Buccolingually, this tooth inclines inward; mesiodistally, it is alined at right angles to the ridge, subject to modification by the indicated compensating curve. It is checked in the working bite lateral relation for contact and in the protrusive to see that it does not interfere.

The next tooth to be set is the maxillary first bicuspid. Fitted with the wax cone, it is placed in approximation with the cuspid and alined to follow the arch form. As the articulator jaws are closed, it is adjusted to occlude with the distal half of the mandibular first bicuspid. Interdigitation or intercusping should be worked out at this time as the inclined plane relationship as well as the balance of the whole articulation is greatly facilitated thereby. This tooth is checked for contacts in the centric and the working bite lateral relations. The mandibular second bicuspid is next set in similar manner, mesiodistally at right angles to the ridge. Buccolingually, it inclines inward. Its mesial half is to occlude with the distal half of the maxillary first bicuspid. It is checked for contacts in the working bite lateral and centric relations, and also checked against interference in protrusive excursions. The setting of the second maxillary bicuspid follows. Its mesial half is occluded with

the distal half of the second mandibular bicuspid. It is checked for occlusions in the centric and the working bite lateral relation. Contacts should be developed in this relation for both the lingual and the buccal cusps.

The first mandibular molar is next set. In this region, the anteroposterior curve usually begins to turn upward. To permit the proper development of interdigitation, it is almost always necessary to leave a small space between this tooth and the mandibular second bicuspid. It is placed at right angles to the ridge mesiodistally, inclined somewhat toward the lingual, and is at this time set to occlude with the distal half of the maxillary second bicuspid in centric relation. It is checked for contacts in the working bite lateral relation and against interference in the protrusive excursions.

The first maxillary molar is now set. Its mesioclusal angle is set in approximation with the distoclusal angle of the second bicuspid. Mesiodistally, it is set to conform to the mandibular curve and it is checked for occlusion first in the centric relation, then in the working bite lateral, and in this latter relation it is also checked for interdigitation with the mandibular molar. This last named tooth is then moved toward the mesial or distal aspect till the buccal ridge of its middle cusps is in line with the buccal groove of the maxillary molar. It is checked in the balancing bite lateral relation and during excursive movements against interference.

We next set the mandibular second molar. Its mesioclusal angle is set in approximation with the distoclusal angle of the first molar, and it is set to occlude with the distal portion of the maxillary first molar. It is then checked for contacts in the centric, the working and balancing bite laterál and the protrusive relation, and against interferences in the excursive movements.

Last to be set is the maxillary second molar. This tooth is first set in correct approximation with the maxillary first molar. Mesiodistally, it inclines forward and buccolingually its inclination is outward. It is checked for contacts in centric, right and left lateral or working and balancing bite and in the protrusive relation. It is checked for interdigitation in the working bite lateral relation and against interference during the excursive movements.

THE COMPENSATING CURVES

The compensating curve has been described as the curved arrangement of the posterior teeth that compensates for the separation of the ridges during the downward and forward movements of the mandible and permits the maintenance of balancing contacts during the excursive movements.

It would be more proper to speak of compensating curves than of a single curve, for we have the anteroposterior curves on both sides and we also have the lateral curves on both sides. If these curves are the means of establishing and maintaining balanced articulation, it seems but logical to establish them with the necessary contacts while setting the teeth and to check them statically and kinematically, i. e., in the positional relations and during the excursive movements made with and upon the setting-up instrument or articulator.

On checking up, if it is found that contacts are lacking or interference is encountered, it is but necessary to modify the curves by altering the axial alinements of the teeth mesiodistally or buccolingually in accordance with the laws of articulation to obtain the desired results. Some shifting of the teeth bodily in a vertical or horizontal direction may

have to accompany the change in axial alinement.

When the posterior teeth have been set on the one side, the same procedure is followed on the opposite side. With the better forms of teeth now available, little grinding is required on the occlusal surfaces of the bicuspids and molars. Cusps may be quite readily made deeper or shallower by judicious grinding, except in cases of marked steepness of the indicated compensating curves, when, for purposes of more intimate contact, the cusps of the maxillary bicuspids are deepened by grinding down the mesial and distal marginal ridge. I rarely resort to such a procedure during the setting of the teeth.

Some modification is desirable in each case, if we are aiming, as we should be, to comply with the individual requirements of the case, particularly as we are for economical and other reasons using stock teeth as furnished by the manufacturers. Such modifications are best accomplished after the dentures are vulcanized, by the grinding-in process. This is done with small engine stones and the use of some form of abrasive paste.

When the teeth have been set up, they should be neatly waxed, the labial, buccal and occlusal surfaces cleaned and another set of wax check records made to be used when the teeth are tried in.

It is hardly possible to cover all details unless one were to write a book on this subject of tooth arrangement. Following is a résumé of the factors involved:

1. Arch form and contour. 2. Axial alinement. 3. Depressions and prominences. 4. Overjet of the maxillary anterior teeth. 5. Setting of the incisal guidance. 6. Determining the amount of the overbite. 7. Development of articulation of the cusps. 8. The introduction of moderate irregularities in the setting of anterior teeth. 9. Interdigitation or intercusping. 10. A survey of the ridge relation in the posterior region to aid in determining the plane of orientation. 11. The development of the anteroposterior and lateral compensating curves. 12. Establishing the positional relation of the teeth to the ridges. 13. Developing the buccal and lingual overjets in the arrangement of the posterior teeth to comply with the special requirements of the tongue and cheeks and to avoid trauma thereof. 14. The establishing of necessary contact points to insure the stability of the dentures and permit good masticatory function. 15. Association of the occlusion of the teeth with the jaw relations; primarily, the centric, right and left lateral and the protrusive. 16. Setting and securing the teeth firmly in a hard wax. 17. Developing the labial, buccal and lingual contours in the wax. 18. Trimming the wax and carving the festoons. 19. Making articulator check records to be used at the time the model dentures are tried in. 20. Applying the laws of articulation in the setting of the teeth. Trying the teeth in with a checkup on appearance, phonation, positional relation and articulation. The modification of the arrangement, the finishing, adjusting and grinding-in are further steps in denture construction. These are not within the scope of this paper.

DISCUSSION

Frederick L. Stanton, New York City: The interesting part of this presentation is the fact that the solution is accredited to the engineers. The solution of any problem in dentistry or any other art depends on the ability of the investigator to state his problem. Now, what is the nature of this problem? It is an engineering problem. I only rise to say that, realizing that orthodontia was an engineering problem, I was led to seek the services of an engineer. And it was through my effort in orienting the dental pro-

fession to the profession of engineering that I came to induce Mr. Hanau to enter our profession. In the future, it will be well to be careful when different professions are asked to try to help in solving our problems, and not to laugh as our efforts were laughed at in 1915. That is one of the things that drove Mr. Hanau out of the field of orthodontia into the field of prosthesis.

W. A. Spring, New York City: Dr. Schlosser, what provision do you make for guiding the lower teeth into the positional relation with the ridge?

Dr. Schlosser (closing): The old school of denture construction warned us that unless we placed the teeth absolutely over the center of the ridge, we should encounter leverages that would raise havoc with the stability of our dentures. This resulted in serious interfering contacts of the upper arches and lower arches as well. According to the laws of physics, conditions were all against us, and it is only by developing a proper balance in the functional occlusion or in the articulation that we can offset the bad effects of leverages as they might be generated by placing the teeth off the ridge. But as I have told you here, it is not merely a matter of mastication; we are dealing with appearance and with phonation; and when we study the progress of resorption as it takes place after extraction, we find that the result in the residual ridge depends, of course, on the contacts, a decrease in the size of the arch. Now, if we were to set the teeth absolutely over the center of the ridge, we should disturb the facial contours greatly; hence, it is my practice in the anterior teeth to work out a contour restoration that will comply as far as it is possible with the laws of esthetics, and then to establish such a balance for the articulation that we will minimize the strains. Another thing in the anterior teeth: We never aim to develop a close or intimate contact of the anterior teeth in the centric relation. We throw the strain or pressure into the bicuspid region. Mr. Hanau spoke to us some years ago of a rocking chair fit, and we sneered a little at it. But if we do establish closer contacts of the anterior teeth, we establish for centric relation what Mr. Hanau termed a stable equilibrium. A stable equilibrium is just the thing we want for the working positions of the mandible. But if we establish a stable equilibrium for the centric or rest position, we place a constant strain on the tissue, and this results in flabbiness of the tissue. So we do not at present develop an intimate contact of the anterior teeth. The strain that we would place on the teeth in the initial act of mastication of food will be adequately carried if we have worked out the necessary preliminaries of proper surface adaptation, plus peripheral extension and adaptation. We will then have for the retention of the dentures maximum adhesion and atmospheric pressure conditions resisting displacement during that initial effort. Then as mastication proceeds, when the food bolus is turned by the tongue to the space between the bicuspids and molars, if we have the old "three point contact," one in the anterior region and two in the molar region, we need not worry so much about leverages or about having the teeth over the ridge. With regard to the posterior teeth, as I have said here, by placing the crests of these teeth over the center of the ridge, we take care of special requirements of lip, tongue and cheek.

EMPYEMA OF THE MAXILLARY SINUS—CONSERVATIVE AND EFFICIENT SURGERY*

By ARTHUR E. SMITH, D.D.S., M.D., Los Angeles, Calif.

TOPOGRAPHY

THE maxillary sinus varies greatly in form and in size with different individuals; and even in the same individual, its size and thickness of walls may vary. It is the largest of the paranasal sinuses and is located beneath the orbit and to the lateral side of the nasal fossa. It presents the form of a three-cornered pyramid (Fig. 6). The nasal cavity forms the base, and the apex is in the zygomatic process. It is bounded laterally and above by thin walls of bone. The floor is bounded by the alveolar process. The sinus may contain septums of bone and grooves in which blood vessels are located. Nerve tissue may be found along the floor of the sinus just above the apices of the teeth.

The antrum communicates with the middle meatus by a small slitlike aperture known as the ostium maxillare, beneath the middle turbinate, about the center of the middle meatus, which is unfortunately located about 25 mm. above the floor of the sinus (Figs. 1 and 2). The infra-orbital nerve is located within the roof of the sinus (Fig. 3). The posterior wall presents the posterior dental canal or groove. The anterior, middle and posterior dental nerves which supply the upper teeth pass through minute canals in the substance of the antral walls (Fig. 3). The floor of the antrum is situated a short distance below the level of the floor of the nose (Fig. 1), and the apices of the teeth situated directly beneath it may actually perforate its floor (Fig. 4), or elevations of the bone may be present which indicate the presence of the root ends (Fig. 5). The antrum walls are extremely thin, and, for this reason, tumors, exudate or pus under pressure will cause a bulging, either forward, with a protrusion of the cheek; upward, with ocular disturbances, or medial, with partial obliteration of the nasal fossa.

The sinus is lined by a delicate mucoperiosteal membrane, and the mucous layer of this membrane contains many mucous glands, which may become infected with the development of polypi or cysts. The anterior, middle and posterior superior dental nerves forming the outer nerve loop may become involved, and the patient may suffer from neuralgia (Fig. 3, outer nerve loop).

ETIOLOGY AND PATHOLOGY OF MAXILLARY SINUSITIS

Normally, the maxillary sinus contains air and has free ventilation. If deprived of air, the mucous membrane lining the sinus becomes involved pathologically. Its location and poor ventilation frequently make it the seat of infections.

The exciting cause of maxillary sinusi-

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tis is pathogenic bacteria. Although the infection may be carried to the antrum by the blood or the lymphatics, this is not a common occurrence. Most cases of maxillary sinusitis are caused from extension of infection via the mucous membrane and alveolar process. I shall tabulate the causes in the order of their importance.

1. Infection may be transmitted from the nasal cavity through the ostium maxillare, arising from acute infectious diseases such as influenza, and the intra-nasal infections which produce pathologic changes in the mucous membrane, such as acute rhinitis, hypertrophy of the tissue covering the middle or inferior turbinate, deflection of the nasal septum causing chronic inflammation or obstruction of the ostium maxillare. There is a continuity of the mucous membrane of the nasal cavity and antrum, and any infection involving the nasal mucous membrane quickly involves the mucous membrane lining the antrum. Infections such as these predispose the mucous membrane to attack, by lowering its normal vitality and resistance to inflammation and infection. Chronic catarrhal inflammation of the mucous membrane lining of the nasal cavity (which is continuous with the antrum) may extend through the hiatus semilunaris and the ostium maxillare, and cause infection of the mucous membrane lining the antrum.

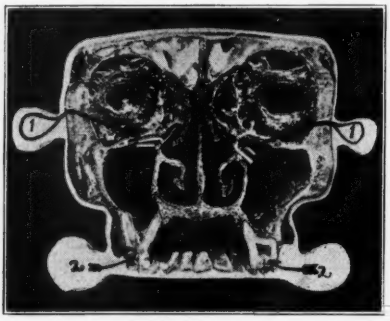

Fig. 1.—Cross-section of antrums. *1*, ostium maxillare; *2*, upper first molar. The close relationship of the apices to the floor of the antrum is evident. The floor of the antrum is on a lower level than the floor of the nasal cavity.

2. The infection, which may be of dental origin, is divided into those arising from acute and those arising from chronic conditions. The acute etiologic conditions include acute alveolar abscess; fracture of the upper jaw or a portion of the alveolar process, and acute and circumscribed or diffused osteitis of the alveolar process. The chronic conditions include chronic periosteitis; traumatic factors; pyorrhea alveolaris; impaction of the upper third molars, and empyema follow-

Fig. 2.—Median section of a wet anatomic specimen. *1*, probe inserted in the ostium maxillare, *2*, which is located in the upper part of the middle meatus, *4*. The middle turbinate, *3*, is turned upward to expose the ostium. *6*, lateral wall of nasal cavity. *5*, inferior turbinate. *7*, floor of nasal cavity. *8*, hard palate.

ing dental service or the rupture of an infected cyst of the maxilla into the antrum. In many cases, the apices of the roots of the teeth located beneath the antrum may penetrate its floor. In other cases, the root ends are so near the floor of the antrum that only a thin lamina of bone separates them, and when dental caries occurs, followed by death of the pulp and abscess formation, pathogenic bacteria pass through the apical foramen to infect the antrum lining (Figs. 4, 5 and 6). I am positive that in many cases the rhinologist overlooks the dental

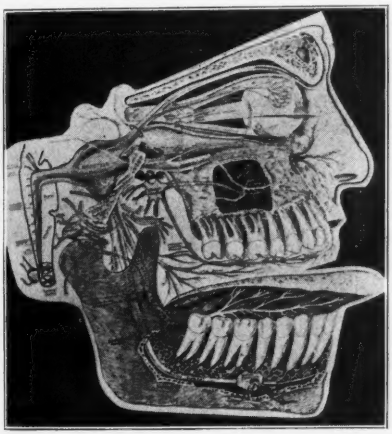

Fig. 3.—Schematic drawing illustrating the nervus trigeminus and the anatomic structures supplied by its branches. (From author's textbook.)

origin of maxillary sinusitis. Extraction of teeth or roots of teeth may cause antrum infection (1) by the passage of pathogenic bacteria; (2) through the medium of septic instruments; and (3) from forcing an infected tooth root into the antrum. Pus follows the line of least resistance, and when the apices of roots either penetrate the antrum or are separated from the antrum by only a thin lamina of bone, it is not difficult to understand why maxillary empyema so frequently follows dento-alveolar abscess.

3. Extension of infection from an infected frontal or ethmoid sinus may be the primary cause of empyema of the antrum. Either of these sinuses may be infected, and the infected material formed in them may infect the antrum via the ostium or it may drain directly into the antrum. Parsons states that the antrum communicates with the frontal sinus in 56 per cent of cases, and he gives these figures after careful examination of a large series of cases (Fig. 7).

The importance of chronic inflammation, which may cause maxillary sinusitis, should not be overlooked. Pericementitis usually follows the death of the pulp or may follow operations on pulpless teeth. The passing of a broach through an infected root canal into the antrum may produce acute maxillary sinusitis.

The dental granuloma which forms about a root apex is the result of defensive action against pathogenic bacteria and may prevent extension of infection from an infected tooth. A small cyst may develop in this granulomatous mass, and, as a result of recurring infection, rupture of the mass may occur and infect the mucous membrane of the antrum floor. The antrum may become invaded and infected from a cyst which has developed from resorptive cavities located within the alveolar process. These cysts may expand toward the hard palate, facial wall or nasal cavity.

The maxillary sinus, during the acute stage, may contain serum, seropurulent fluid or pus. The mucous membrane of the sinus in chronic infection may have undergone partial or complete destruction; it may be hypertrophied or contain fibous tissue, or its surface may be roughened or granular. The bony walls

may be in a state of dissolution from necrosis and caries. In chronic empyema, the antrum is usually filled with polypi. The most striking symptom of chronic empyema is the offensive nasal discharge. The general health of the patient is below par, with loss of weight, anorexia, indigestion, hyperacidity and generally a low evening temperature.

Some rhinologists believe that from 65 to 85 per cent of all maxillary sinus infections are caused from descending infections, i. e., from the frontal or ethmoid sinus or from within the nasal cavity. Cryer stated that 29 per cent of cases of antrum infection had their source in a dental condition. Brophy stated that 75 per cent of cases of antrum infection were caused by diseased teeth. Oakman stated that 90 per cent were of dental origin. Both Ballenger and Luc state that the cause is equally divided between nasal and dental conditions. The pathology and clinical history of empyema of the antrum in my experience warrant me in stating the source of infection to be 75 per cent dental and 25 per cent nasal. In treating patients suffering with maxillary sinus, I have observed that only a few patients possess sound teeth. This fact leads one to believe that a high percentage of the cases have their source in the region of the maxillary sinus. If the infection is from the nasal cavity, why is it that we so frequently see patients with antrum infection and suspicious teeth in continuity with the antral floor? I have had many cases in which a large opening existed in the naso-antral wall, which had been removed to effect a cure. In all cases, examination revealed dead pulps, with pus discharging into the antrum. Quite true, the naso-antral opening prevented serious complaint on the

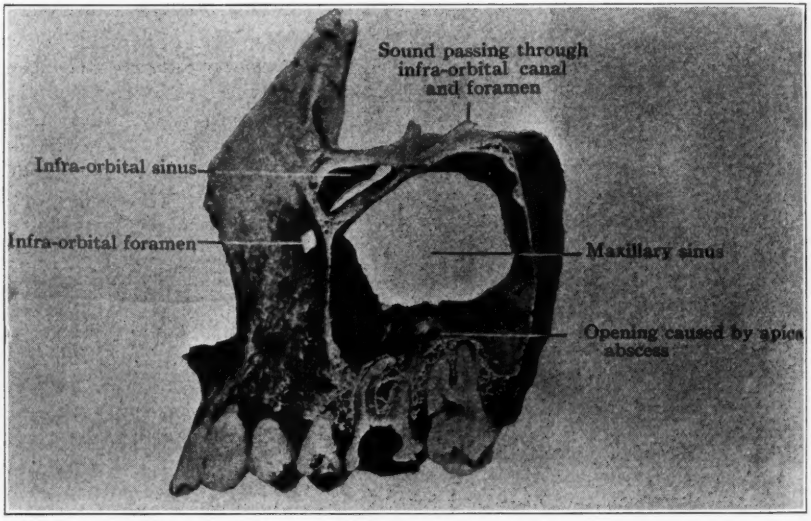

Fig. 4.—Perpendicular section with the lateral wall of the antrum removed and showing the apices of the roots penetrating the antral floor. (Cryer.)

part of the patient, because the pus was discharging and the patient tolerated the condition. The removal of the naso-antral wall produced free drainage and prevented pain from confined pus, but the source of the infection was not removed and the patient continued to experience the obnoxious odor and taste of pus and suffered generally from continued pus absorption.

SYMPTOMS

The characteristic symptoms are an increase in temperature; considerable pain; a feeling of fulness in the head, and an abundant discharge of fluid, watery, mucous or mucopurulent in character, from the nostril of the affected side. There is considerable pain, with tenderness and edematous swelling of the face, and, in many cases, the thin bone may crepitate under pressure. The pain is often expressed by the patient as extreme pressure or neuralgia. The presence of pus is one of the most important factors, and a simple test will, as a rule, prove whether or not pus is seeping from the antrum. This is accomplished by inserting an applicator into the nose and wiping the mucous membrane in the middle meatus, then having the patient lean forward with his head between the knees, turning his head sideways, with the affected side upward, and retaining that position for several minutes. If pus is present, it will in all probability escape through the ostium. With the patient in an upright position, a nasal applicator is introduced and the middle meatus examined for pus. In all cases, the operator should use a nasal speculum and, by illumination, examine the mucous membrane at the location of the ostium maxillare for pus and for incrustations of pus on the hair follicles of the anterior nares. In actute cases, the ostium may be completely blocked, thereby obstructing the discharge of pus; which adds greatly to the intensity of the pain and the severity of the symptoms. The nasal wall may be seen bulging. Neuralgia of the infra-orbital nerve and its branches may accompany the pain and tenderness over the region of the antrum. If the infection is severe, an exophthalmus may be present, with great tenderness in the alveolar process and teeth. The teeth may feel irregular, and occlusion may cause pain. In some cases of maxillary sinusitis, little or no pain is experienced, because the exudate is draining through the ostium maxillare when the patient lies down.

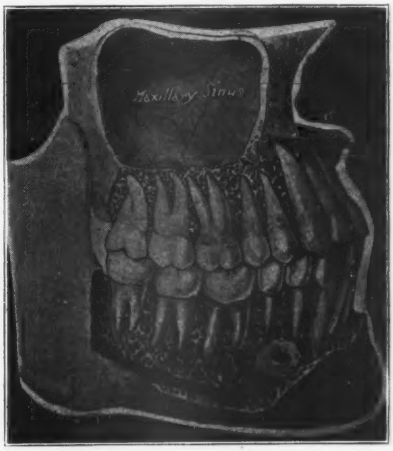

Fig. 5.—Labial and buccal plates of bone together with the lateral wall of the antrum removed, exposing the maxillary sinus and the roots of the teeth. The close relationship of the root apices to the antral floor is evident. (Retouched and modified from Spalteholz.)

DIAGNOSIS

Factors to be considered in making a diagnosis are:

1. Pain, swelling and tenderness over the affected area.

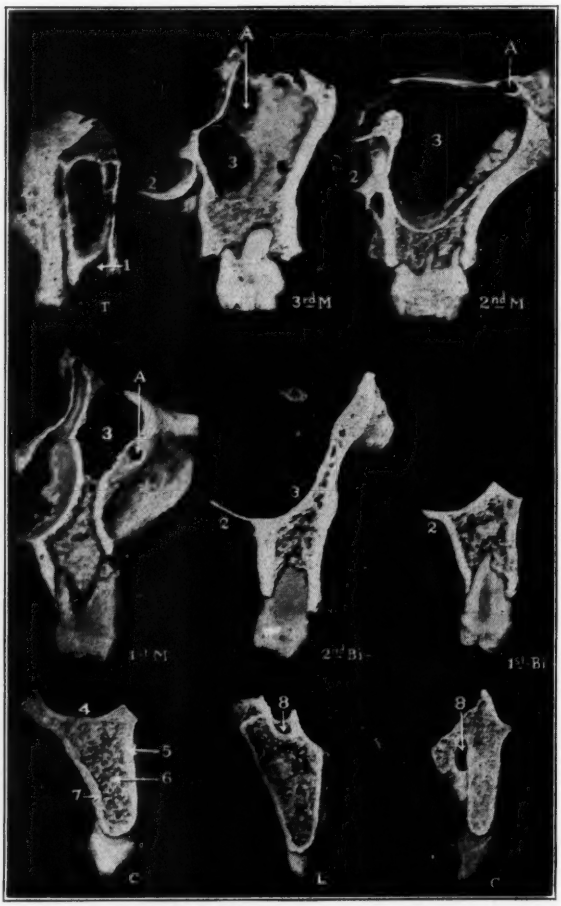

Fig. 6.—Superior maxillary bone which has been incised through the superior maxillary sinus and between the various teeth. *A*, intraorbital foramen and canal; *T*, tuberosity of the superior maxillary bone; *C*, central incisor; *L*, lateral incisor; *C*, cuspid; *1*, pterygoid plate; *2*, floor of the nasal cavity and hard palate; *3*, maxillary sinus; *4*, nasal cavity; *5*, external alveolar plate; *6*, middle table of intercancellous bone; *7*, lingual plate; *8*, anterior palatine canal. (From author's textbook.)

2. The presence and reccurrence of pus in the middle meatus. Its absence is not conclusive that a maxillary sinusitis does not exist. R. Boyd Bogle states that, in some cases, pus may be present in the antrum with no discharge from the nose, the pus being confined within the antral lining.

3. Pain in the alveolar process and elongation of the teeth in affected antral region.

4. Fulness in the roof of the mouth.

5. A difference in the two sides of the face, due to edematous swelling on the affected side.

6. Headache and disagreeable taste in mouth on arising in the morning, due to draining of pus into the throat.

7. Iridiocyclitis; impairment of vision, conjunctivitis, and a feeling of fulness in the orbit.

Transillumination is a valuable adjunct in diagnosis. It reveals a diminution of light transmission on the diseased side as contrasted with the normal rosy color under the eye on the normal side. The pupil on the normal side will be visible; while on the diseased side, the pupil will be invisible owing to opacity or nontransmission of light. Transillumination is not always a positive means of diagnosis, as there may be an infiltration process of the lining over the floor, without engorgement, or there may be in the bones surrounding the antrum a difference in density and thickness which effects translucency. Transillumination, when combined with roentgen-ray findings, is a valuable diagnostic measure.

Roentgenographic photographs, clear in detail, are invaluable in arriving at a correct diagnosis. Roentgen-ray findings should not be taken as conclusive evidence that antrum involvement is not present, but should be considered with transillumination and the clinical findings. The roentgen-ray is valuable in revealing whether we are dealing with maxillary sinusitis alone or a pansinusitis. It may also reveal septums in the antrum and, more particularly, dental disease, cysts, etc.

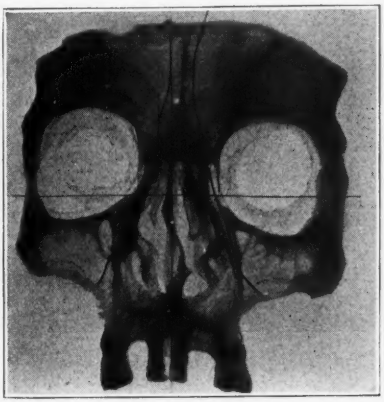

Fig. 7.—Skull showing wires passing downward from the large frontal sinuses through the ostium frontalis into the hiatus semilunaris, and into the maxillary sinus, by the ostium maxillare. (Cryer.)

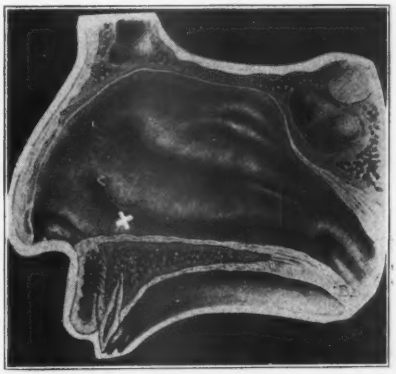

Fig. 8.—The naso-antral wall, the middle and inferior turbinates and the middle and inferior meatus. *X* indicates the location for puncture of the naso-antral wall.

Transirrigation by insertion of a small trocar into the antrum through the thin naso-antral wall at the anterior-inferior portion of the inferior meatus is a valuable diagnostic measure, because, if pus is present, it can be aspirated. The antrum may be irrigated and a return of turbid fluid indicates the presence of pus.

DIFFERENTIAL DIAGNOSIS

Empyema of the maxillary sinus must be differentiated from symptoms caused by tumors, maxillary cysts, osteomyelitis of the jaw, acute alveolar abscess, impacted upper third molar causing pressure and pain, fracture of the superior maxilla, periosteitis, syphilis and actinomycosis.

PALLIATIVE TREATMENT

In many cases, it is necessary to render assistance to a patient before an operation is decided on. If the ostium maxillare is closed, owing to an enlarged turbinate, hypertrophied or inflamed tissue, many

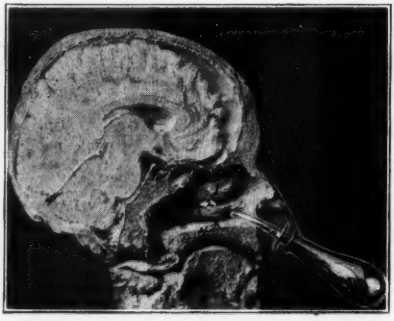

Fig. 9.—Median section of wet anatomic specimen showing the position of the trocar for entering the antrum through the naso-antral wall. *1*, middle turbinate; *2*, middle meatus; *3*, inferior turbinate; *4*, inferior meatus. (Specimen furnished by Dr. Varian, University of Southern California, Dental Department.)

times the unplugging of this opening will render relief. Efficient anesthesia can be secured by applying procain crystals dissolved in 1:1,000 solution of epinephrin to the mucous membrane in the region of the ostium. The epinephrin causes a constriction of the tissue, which may reestablish the opening. Irrigating the nose with warm Ringer solution or surgical solution of chlorinated soda (Dakin's) may aid in relieving congestion. The use of steaming hot moist packs on the face will aid materially in reducing pain and often assists in establishing drainage. Relief may be given if the patient lies across the bed, face downward with head hanging over the edge, closing the nostril on the unaffected side and blowing through the nostril of the affected side with the mouth open. This procedure may start drainage owing to the suction created over the ostium maxillare. There should be a thorough elimination of the alimentary canal by the administration of 2 grains of mercurous chlorid (calomel), fol-

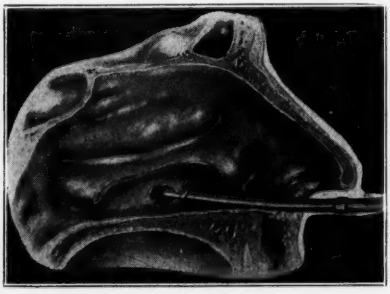

Fig. 10.—Opening the maxillary sinus by removing a portion of the naso-antral wall with Wagner's punch forceps. (Loeb.)

lowed by a saline cathartic. Administration of powder of ipecac and opium (Dover's) in 5 grain doses will prove beneficial in allaying the pain. Palliative treatment is of limited value, but some good is derived from it until surgical measures can be instigated.

SURGICAL TREATMENT

The surgical treatment is based upon the well-known principles of surgery, which are free drainage, removal of the cause of infection and irrigation. If the cause is some constitutional disease, such

as influenza, general treatment should be given, or if the causative factor is a local one, such as an abscessed tooth or other dental disease, it must be eradicated.

The method of surgical procedure depends on the three following factors: (1) the case in an acute stage; (2) the case in a chronic stage, and (3) the extent and involvement of the tissues.

In a chronic condition in which there has been a discharge of pus, causing considerable involvement of bone and soft tissues, which should be removed, the mere insertion of a trocar by the intranasal route and treatment instituted in this manner are useless.

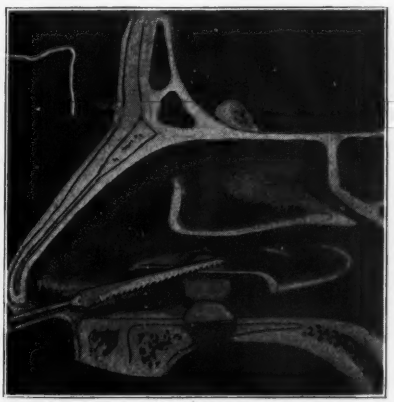

Fig. 11.—Opening into the antrum with Vail's convex saw. A mucous membrane flap is resected from the naso-antral wall. (Retouched after Ballenger.)

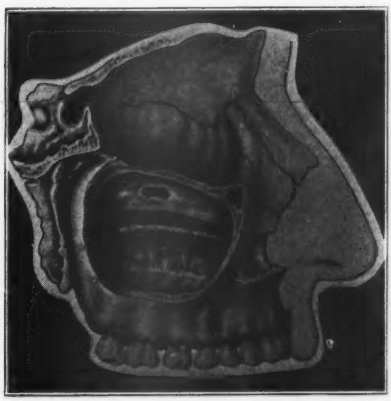

Fig. 12.—Canfield's operation; using the flap from the nasal wall. The outer wall is removed to show the flap. (Loeb.)

SURGICAL METHODS OF OPERATING

I shall give only a brief résumé of the radical surgical methods in order to show the striking contrast between the radical and the conservative surgical procedures.

1. Intranasal route:
   A. Puncturing the nasal wall through the anterior portion of the inferior meatus with a trocar.
   B. Resection of a portion of the naso-antral wall through the inferior meatus, including (a) Vail's method. (b) Canfield's method. (c) Canfield-Ballenger method. (d) Dahmer's method.
2. Extranasal route:
   A. Through the anterior-lateral wall of the antrum, including the radical operations of Kuster and Caldwell-Luc.
   B. Intral-oral, i. e., through the alveolar process or root socket.
3. Intranasal-facial route. The technic and advantages of this method will be discussed later in this paper.

Puncturing the Nasal Wall with a Trocar.—This method is of value in diagnosis and in treating acute and subacute cases, being often sufficient to effect a cure without resort to the more

radical surgical procedures. Clinical experience teaches that a small opening through the mucous membrane and thin bone readily closes. The small puncture is located in the anterior part of the inferior meatus, beneath the turbinated bone. This point is at a low level of the antrum; which aids in discovering pus by aspiration and facilitates drainage (Fig. 8).

The naso-antral wall at the anterior-inferior part of the inferior meatus is punctured with a curved trocar (Fig. 9).

Fig. 13.—Canfield-Ballenger operation. *3*, the naso-antral angle removed, the maxillary sinus being exposed thereby.

The point of the trocar is held firmly against the naso-antral wall and, with firm, rotating lateral and upward pressure, the stylet point enters the sinus, which is easily detected by the sudden release of pressure. The trocar must be under control and should not enter the antrum too far as damage to the orbit might occur when the stylet is removed. Pus may be seen at the distal end of the cannula. If no pus is observed, a hypodermic syringe is attached to the cannula for the purpose of aspiration. If the end of the cannula is in the antrum and its lumen is free, and pus is present in the antrum proper, it may be withdrawn. Slight resistance to aspiration indicates that the end of cannula is not in the sinus or else that the lumen is clogged. If this is experienced, the position of the cannula is changed. Without pressure, the antrum is now irrigated by using a warm Ringer solution or 0.5 per cent surgical solution of chlorinated soda, until the return flow is clear. Emphasis is placed on

Fig. 14.—Dahmer's method of operating and using a nasal flap for the floor of the maxillary sinus. (Loeb.)

the danger of serious complications resulting from the injection of either air or irrigating solution under undue pressure. Briefly, they are: 1. Dissemination of infection by continuity of mucous membrane and contamination of adjoining sinuses. 2. Pyemia or septicemia. 3. Emphysema of the soft tissues. 4. Air embolism. 5. Hysteroepilectogeric attacks due to vagus irritation.

Resection of a Portion of Naso-Antral Wall Through the Inferior Meatus.—This method has had many advocates

among the rhinologists, but has never been popular with oral surgeons. The amount of tissue removed depends on the pathologic involvement and the condition of the inferior turbinated bone. The disadvantage of removing a portion of the naso-antral wall is that the opening may remain permanent unless a flap of mucous membrane is made to cover it, which many times is unsatisfactory (Fig. 10).

I desire to emphasize that the resection of a portion of the naso-antral wall is, in most cases, unnecessary, as efficient results can be obtained by treating the antrum through a trocar opening in con-

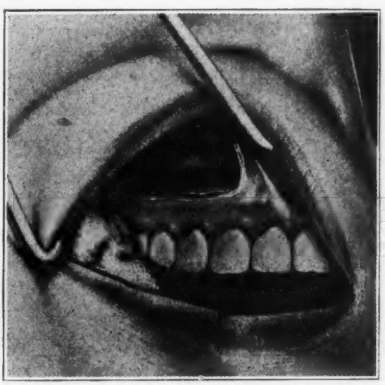

Fig. 15.—Caldwell-Luc operation; nasal wall removed. (Loeb.)

junction with a small opening on the anterior-lateral surface of the superior maxilla. This method will be discussed under the intranasal-facial route.

Resection of a Portion of the Middle and Inferior Meatus. — Vail operation. This consists in opening the naso-antral wall at the anterior portion of the inferior meatus with a sharp instrument, such as the Welhelmenski trocar or a bur. The next step is to introduce the Vail saw, which is held in an oblique position, a circular incision being made. A mucoperiosteal flap is elevated and turned down as seen in Figure 11.

Canfield operation. This consists in removing the bone of the anterior-inferior wall of the antrum, then elevating the mucoperiosteum on the medial side of the inferior turbinated bone. The naso-antral wall is resected, a flap of mucoperiosteum, which is used at the conclusion of the operation, being left to cover the floor of the antrum. With the Canfield method, a direct view of the sinus is obtained thorough curettage being thus obtained (Fig. 12).

Fig. 16.—Operation through the alveolus.

Canfield-Ballenger operation. This consists of making an incision 1 cm. anteriorly to the inferior turbinate, extending over the entire length of the piriform aperture. The mucoperiosteum is elevated. The antrum is opened through the nasal angle and extended laterally to allow a direct view of the interior of the sinus. The antronasal wall is removed below the inferior turbinate. The mucoperiosteum is used to cover the floor of the antrum (Fig. 13).

Dahmer operation. This consists in resecting the anterior half of the inferior turbinate. An incision is made through the mucoperiosteum posteriorly, superiorly and anteriorly and the mucoperiosteum is separated from the bone with the retention of the pedicle. The flap is placed over the floor of the antrum (Fig. 14).

Maxillary Sinus Operations by Extranasal Route. — Kuster operation. This consists of entering the antrum through the cuspid fossa, a route which is favored by many operators. A horizontal incision of 1½ inches is made along the labiogingival junction, just above the apices of the teeth. A flap is resected upward over the cuspid fossa and an opening is made through the anterior antral wall.

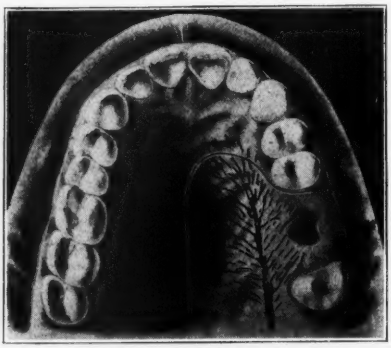

Fig. 17.—Outline of the palatal flap and the posterior palatine artery which supplies the flap with blood. (Dunning.)

Caldwell-Luc operation. This consists of making an incision above the apex of the lateral incisor and extending it distally parallel to the apices of the upper teeth, to a point opposite the upper third molar. A mucoperiosteal flap is raised and the bone exposed. The technic of this operation consists of removing the bone from the anterior extremity of the antrum to a point below the malar process and upward from the alveolar margin to a point 1.5 cm. beneath the infra-orbital margin. In addition to this radical procedure, the nasal wall is also resected in the region of the inferior meatus and, in most cases, the inferior turbinate is removed (Fig. 15).

The alveolar method was for many years a popular procedure. Even at the present time, some operators select this method, the reason being that it is an extremely easy way to enter the sinus and it gives quick relief to the patient. The procedure was to remove a tooth, and then enlarge the alveolus to reach the antrum (Fig. 16). If an infected tooth is causing maxillary sinusitis, it should be removed, but the enlargement of the socket for antrum treatment is problematic, if not contra-indicated. A sound or useful tooth should never be sacrificed.

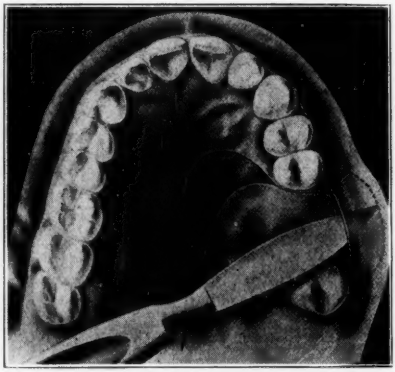

Fig. 18.—The palatal flap which has been elevated and moved laterally. The lateral edge of the palate flap is tucked under the medial portion of the buccal flap. The epithelial surface is removed from that part of the palatal flap which is tucked under the edge of the buccal fold. (Dunning.)

There are five contra-indications to the treatment of maxillary sinusitis through an alveolar socket: 1. The

patient may be sacrificing a tooth of great value. 2. After a tooth has been removed, septums may be found, dividing the antrum in two or more compartments; which interferes with free drainage. 3. In case the opening through the alveolar socket is of small diameter, much trouble may be experienced in keeping the opening patent. If the opening is made quite large, there may be considerable difficulty in getting the alveolus to close. 4. It is impossible to observe and to explore the sinus efficiently through such a small opening. 5. There is danger of contamination from oral fluids, food, infected teeth, tonsils, etc.

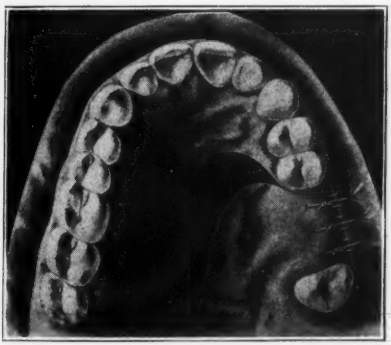

Fig. 19.—Palatal flap and buccal fold sutured together. An opening of long standing connecting the antrum with the oral cavity is quickly closed and healing of the tissues follows rapidly after this plastic operation. (Dunning.)

Fig. 20.—Position of the trocar for entering the antrum through the naso-antral wall. *1*, the location of the opening on the facial surface of the superior maxillary bone. (Skull lent for photographic purposes by Dr. Varian.)

Carefully made roentgenograms, taken before removal of a suspected tooth, and careful objective examination of the socket will determine the presence or absence of pathologic destruction of the alveolar process about the apices of the offending tooth. The antrum may be entered owing to the removal of diseased tissue about the root apex by curettage. An infected tooth may cause a chronic, low grade infection of the antrum with little or no discomfort to the patient. This low grade infection is arrested after the removal of the infected tooth without enlarging the opening into the antrum. The prolonged treatment of the antrum through an opening in the alveolar process, packing with gauze, or using a rubber plug, has been practiced in the past, but present-day knowledge and modern practice have supplanted such treatment by more efficient surgical procedures. A drain or packing inserted into the socket draws secretions from the mouth by capillary attraction, thereby counteracting the desired progress of treatment. If the infection has been caused from an infected tooth and the removal of diseased tissue about the tooth apex has caused a small opening into the antrum, it is deemed advisable to give the patient the benefit of the doubt and, for observation, it can be irrigated via the tooth socket, the opening being kept closed with a fitted metal saddle. This saddle allows pus to drain from the antrum but prevents mouth

secretions and food from being drawn into the antrum. The saddle acts as a one-way valve seal. It is possible that the infection may be of a mild type and that resolution will take place. If the symptoms do not subside within a few days, the nasofacial operation should be performed. It is true that, many times, the removal of an infected tooth will cause maxillary sinusitis symptoms rapidly to subside, thus leading the operator to believe that he has affected a cure, only to be followed soon by a recurrence. I believe that, in nearly every case, the safe and sane surgical procedure is to avoid all treatment via the alveolar socket, and to close the wound and employ nasal drainage.

I severely condemn the packing of the socket or opening with gauze, a rubber plug or any material, to retard closure. In due time, if the opening does not close, a plastic operation should be performed. I have, in many cases used the plastic operation advocated by Henry S. Dunning, with gratifying results. By this method, a palatal flap is prepared which extends from the junction of the hard and soft palates in the median line, to a point 1 cm. posterior to the nasopalatine foramen (Fig. 17). The periosteum is not included in the flap. The lateral side is incised and the tissue about the opening is properly prepared for the reception of

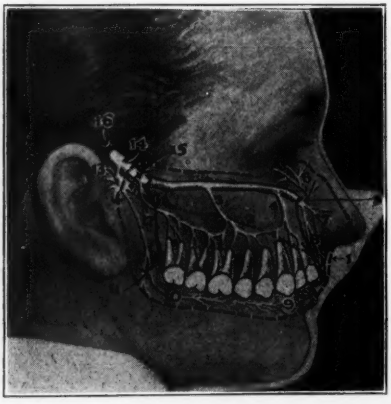

Fig. 21.—Area anesthetized by the second division blocking indicated by the outline marked. *1*, solution injected at *X*, marked *15*. *2*, nasopalatine nerve; *3*, middle superior dental nerve; *4*, anterior superior dental nerve; *5*, infra-orbital foramen and nerve; *6*, infrapalpebral nerve; *7*, lateral nasal nerve; *8*, superior labial nerve; *9*, overlapping of nasopalatine and anterior palatine nerves; *10*, anterior palatine nerve; *11*, posterior palatine foramen; *12*, posterior superior dental nerve; *13*, sphenopalatine ganglion; *14*, second division of the fifth nerve; *16*, foramen rotundum. (From author's textbook.)

Fig. 22.—First position of the needle for blocking the second division of the fifth nerve by the author's intra-oral method. The point of puncture is located in the reflection of the mucous membrane situated between the cheek and the gum tissue, bucally to the upper third molar. (From author's textbook "Cheek Anesthesia and Allied Subjects.")

the flap (Fig. 18). The buccal tissue is elevated, and the palate flap is slid laterally to cover the opening into the antrum, its lateral edge being placed in correct apposition with the buccal flap and then sutured (Fig. 19). In many cases, it is advisable to close the oral opening, establish drainage and continue treatment through the nasal cavity by use of a trocar in the anterior inferior meatus.

INTRANASAL-FACIAL SURGICAL TECHNIC

The intranasal-facial surgical technic, employed by me consists in creating an opening into the antrum through the facial surface of the superior maxillary above the second bicuspid and puncturing the naso-antral wall at the anterior-inferior part of the inferior meatus with a trocar (Fig. 20). The surgical technic herewith described has been employed for several years with excellent results and has been found highly satisfactory in practically all cases with the exception of the case wherein pathologic destruction demands radical surgical procedure.

Local Anesthesia Technic for Intranasal Facial Operation.—The operative regions are anesthetized by the direct application and deep nerve block methods. The nasal and oral cavities are rendered as nearly aseptic as possible by the use of an antiseptic solution in an atomizer.

Deep Block Injection.—The blocking of the superior maxillary division of the fifth nerve by the intra-oral method is highly satisfactory because it blocks the entire second division at a point where

Fig. 23.—Wet specimen illustrating the needle in correct position along the lateral portion of the tuberosity for blocking the second division of the fifth nerve. *1*, long buccal nerve; *2*, lingual nerve; *3*, inferior dental nerve; *4*, mandibular nerve; *5*, auriculotemporal nerve; *6*, foramen ovale; *7*, posterior superior dental nerve; *8*, foramen rotundum; *9*, (upper) second division crossing sphenomaxillary fossa; *9*, (lower) posterior superior dental foramen; *10*, posterior portion of the infra-orbital canal. (From author's textbook.)

Fig. 24.—Application of procain-epinephrin to the naso-antral wall in the region of the inferior meatus.

no inflammation exists and does not depend on the solutions being diffused through the bony plate as is the case from infra-orbital deep block anesthesia or from deep infiltration. When properly executed, this injection is easily and quickly accomplished and the results are gratifying. Four cubic centimeters of a 2 per cent procain-epinephrin-Ringer solution is injected, and after ten minutes, the upper jaw will be completely anesthetized (Figs. 21, 22 and 23). Following this deep block injection, the direct application method is employed in the nasal cavity.

Direct Application.—A nasal speculum is employed (Fig. 24) to dilate the nares so that the naso-antral wall of the superior and inferior meatus may be exposed to view. An applicator moistened with a 1:2,000 solution of epinephrin, the excess being removed, and then dipped into powdered procain is used. The mucous membrane covering the naso-antral wall of the inferior meatus is swabbed, enough pressure being employed to massage the surface, which aids absorption. After three applications at one-min-

Fig. 25.—Introduction of tampon into the nasal cavity. It is packed against the naso-antral wall in the region of the inferior meatus. The tampon contains procain-epinephrin.

Fig. 26.—Moorehead band and retractor. The upper lip is elevated and the cheek is retracted to show the point of entrance of the antrum through the facial wall of the superior maxillary bone. *1*, outline of incision with base of flap upward.

ute intervals, a tampon which has been dipped in a 20 per cent solution of procain and 1:2,000 solution of epinephrin is packed into the nares in close contact with the mucous membrane of the inferior meatus (Fig. 25). The tampon is left in position while anesthetization from the second division injection is awaited. The foregoing procedure will completely block the terminal nerve endings and complete the anesthetic cycle

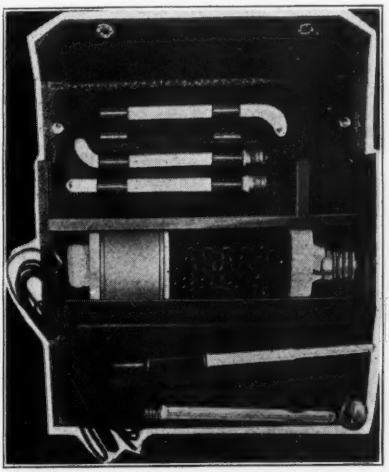

Fig. 27.—Transilluminating outfit. (Designed by Cameron.)

when combined with the intra-oral second division deep block injection.

Facial Surgical Technic.—The retractor with head band is placed in position, and the upper lip is elevated and the cheek drawn back (Fig. 26). The mucous membrane covering the anterior and lateral surfaces of the superior maxillary is dried and a 2 per cent solution of mercurochrome is applied over an area extending from the median line to the upper third molar. An incision through the tissues to the bone is started 1 cm. above the root of the cuspid, being directed downward, then posteriorly and upward to a point 1 cm. above the buccal roots of the upper first molar. This incision will make a pedicled flap which will be approximately 25 mm. in width and from 15 to 20 mm. in length (Fig. 26). The mucoperiosteal flap is carefully separated from the bone, care being exercised to avoid injury of the infra-orbital nerve or its branches, and the bone covering the anterior wall of the antrum is exposed. An opening is made through the thin wall with a bone bur, 1 cm. above the

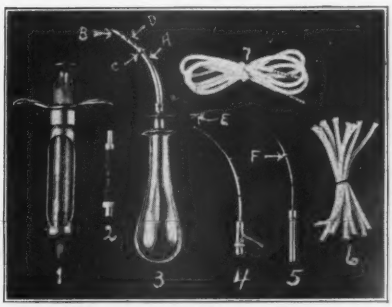

Fig. 28.—Instruments designed by the author for treating maxillary empyema. *1*, hypodermic, 5 c.c. capacity; *2*, connection used between syringe and cannula; *3*, trocar, consisting of cannula *A*, stylet *B*, safety guide stop *C*, and numerous openings in the cannula tip at *D* to facilitate rapid drainage when flushing antrum with curved needle *4*; *5*, curved applicator with notched end *E* for rapid insertion of drain *6* through cannula *A*. *F*, indicator; *7*, shoelace.

apex of the second bicuspid. The opening is then enlarged by chisels, rongeur forceps or a Wagner punch. An opening approximately 15 mm. in diameter is made, which permits thorough examination of the interior of the sinus (Fig. 20). The sinus is illuminated by a small diagnostic lamp, as shown in Figure 27. A small safe edge loop curet is inserted and

an examination is made for polypi and to determine the extent of pathologic destruction. The opening is enlarged if occasion demands it, so that efficient surgery can be rendered.

The Intranasal Surgical Technic.—Following the opening of the antrum through the facial surface, the examination thereof and the removal of diseased tissue, the next surgical procedure is to puncture the naso-antral wall at the anterior inferior part of the inferior meatus.

The anesthetic nasal tampon is removed and 2 per cent mercurochrome is applied to the mucous membrane covering the inferior meatus. A curved trocar (Fig. 28) is inserted in the proper location (Figs. 8 and 9), and by a firm, rotating, outward pressure, the sinus is entered by puncturing the thin naso-antral wall (Fig. 29). Care should be taken in confining the tip of the trocar to the naso-antral wall at its lowest point. When it enters the antrum, the pressure is suddenly released. The relationship of the end of the trocar to the floor of the sinus is observed via the facial opening. The safety stop on the cannula is in contact with the naso-antral wall and prevents the trocar from entering the antrum too far (Fig. 30). The stylet is removed leaving the cannula in position; the flexible needle (*4*, Fig. 28), is locked in the cannula. This makes possible the flushing of the antrum with a return flow. If advisable, a hypodermic syringe is attached and the sinus is flushed with a warm Ringer or 0.5 per cent surgical solution of chlorinated soda (Figs. 31 and 32). A drain consisting of a section of round shoelace is next inserted through

Fig. 29.—Position of trocar for puncturing the naso-antral wall. *1*, tip of trocar in antrum; *2*, stop guide against naso-antral wall; *3*, middle turbinate; *4*, inferior turbinate. Note the gripping action of the hand on the trocar.

Fig. 30.—Position of trocar on wet specimen. *1*, floor of antrum; *2*, naso-antral wall; *3*, guide stop; *4*, floor of nasal cavity.

the cannula (Fig. 33) with a notched end needle applicator (*5*, Fig. 28). The distance the drain has been inserted into the antrum is easily determined because the relationship of needle applicator to cannula is observed (Figs. 34 and 35). Besides, direct observation can be made through the facial opening. With the needle applicator holding the end of the drain inside the antrum, the cannula is retracted over the applicator, which leaves the needle and drain in position (Fig. 36). The needle is now withdrawn, which leaves the drain 1 cm. within the antrum and 2 cm. in the nasal cavity (Fig. 37). The white shoelace, with its central core removed, makes an excellent drain, because it is small, round and so woven as to retain its shape, and it does not fray or ravel (Fig. 28, *6*). The facial opening is now closed by bringing the flap into position and suturing.

Fig. 31.—Cannula and irrigating needle in position through the naso-antral wall and in the antrum. *1*, floor of the antrum; *2*, irrigating needle; *3*, openings in end of cannula to facilitate rapid return of the flow of the irrigating solution through the cannula; *4*, guide stop; *5*, floor of nasal cavity.

Fig. 32.—Cannula and irrigation needle in correct position in antrum. *1*, end of perforated cannula; *2*, end of irrigation needle; *3*, middle turbinate; *4*, inferior turbinate; *5*, stop guide; *6*, rubber tube attached to irrigating needle for conveying return flow of irrigating solution to pus basin.

ADVANTAGES OF THE INTRANASAL-FACIAL METHOD

The advantages of this method are:

1. It is highly conservative, requiring the removal of a very small amount of normal tissue, and it can be elaborated if the extent of diseased tissue demands it.
2. It makes possible a thorough examination of the sinus.
3. In possibly 95 per cent of cases of maxillary empyema, operation can

be successfully performed without the removal of excessive normal tissue by this conservative method.

4. The facial opening is closed at the time of operation and heals readily.
5. The trocar and drain applicator make possible the insertion of a drain at a low level of the sinus, which allows free drainage.
6. A puncture has been made only in the naso-antral wall, which makes possible postoperative flushing of the sinus. Further, the opening closes readily when infection is arrested and the drain is removed.
7. No permanent opening remains between the antrum and nasal cavity, such as results usually from radical operation.

Fig. 33.—Technic of inserting the drain through cannula. *1*, cannula; *2*, round loop drain; *3*, applicator having the same radius as the cannula; *4*, guide indicator.

Fig. 34.—Position of drain applicator after the drain has been forced through the end of the cannula. *1*, guide stop which indicates that the drain is past the end of the cannula.

POSTOPERATIVE TREATMENT

The general physical condition of the patient should be carefully observed and treated if necessary.

It is seldom necessary to treat the sinus within forty-eight hours after operation. If the drain has been properly placed, the sinus should drain freely. Mild mercurous chlorid (calomel) followed by a saline laxative should be prescribed. If postoperative pain requires it, a sedative is given. In forty-eight hours, the nasal and oral cavities are sprayed with a warm antiseptic solution. The naris is dilated with a nasal speculum, and a tampon containing 20 per cent procain solution is packed against the inferior meatus and

left in position for five minutes, after which it is removed and a 2 per cent mercurochrome solution applied. The drain is removed, and both drain and naso-antral opening are examined for pus. The trocar is carefully inserted into the opening until the safety ring is in contact with the naso-antral wall (Fig. 30). The return flow needle is inserted into the

Fig. 35. Wet anatomic section illustrating: *1*, floor of the antrum; *2*, cannula; *3*, drain applicator; *4*, end of drain; *5*, guide stop; *6*, guide stop on drain applicator which reveals the distance the looped drain has entered the antrum through the end of the cannula; *7*, floor of the nasal cavity.

cannula and locked in position. A syringe is now attached (*4*, Fig. 28) and the sinus is gently flushed with a warm Ringer or 0.5 per cent surgical solution of chlorinated soda (Fig. 32). The return flow is noted for clearness and turbidity. Irrigation is continued until the return solution is clear. The drain is inserted through the cannula by using the needle applicator (*5*, Fig. 28). The needle is marked so that the operator will know the relationship of the drain to the end of the cannula. The end of the cannula is inserted into the antrum a known distance owing to the safety stop, and the cannula is withdrawn over the needle ap-

Fig. 36.—Position of cannula and drain applicator, leaving the drain extending into the antrum through the naso-antral wall puncture. *1*, end of drain; *2*, cannula which has been withdrawn over the drain applicator which leaves the drain in correct position.

plicator, which leaves the drain in correct position (Fig. 37). Postoperative irrigation is given, if necessary or advisable, its frequency depending on the evidence of pus or exudate.

When infection is arrested, the drain is discontinued and the puncture readily

closes. It must be remembered that the paramount features in treatment is to establish ventilation and thorough drainage; to remove pathologic tissue, and to arrest the source of infection.

CONCLUSION

I appeal for more thorough diagnosis, and a closer cooperation between rhinologist, and oral surgeon, especially with the descending infection type of cases. I condemn the removal of a useful tooth and the treatment through the oral cavity, because the opening is inadequate

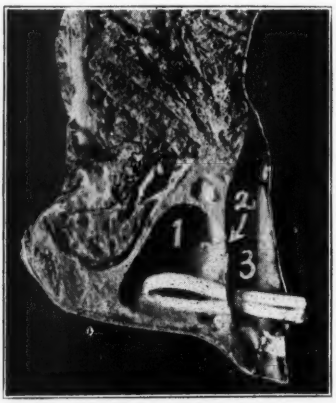

Fig. 37.—Cross-section of wet anatomic specimen illustrating the correct position of the drain. *1*, floor of the antrum; *2*, naso-antral wall; *3*, floor of the nasal cavity. Note the distance that the drain extends into the antrum and nasal cavity. The looped drain prevents fraying.

for visualization of the sinus; and there is a possibility of reinfection and difficulty in closing the opening.

If an oral opening is caused by dental disease, it should be closed as soon as possible. I make a plea also for the intranasal-facial operation, with drainage and postoperative treatment through the nose, because it approaches the natural anatomic and physiologic conditions. The opening on the facial surface of the superior maxillary bone is large enough for sinus visualization and to permit the removal of pathologic tissue. I condemn all radical surgical methods unless they are absolutely indicated, because of the extensive tissue and bone destruction involved.

I wish to emphasize the postoperative complications which may arise from radical operations, which usually leave a permanent large opening in the naso-antral wall and cause reinfection of the sinus, sacrificing a part of the inferior and middle turbinate bones, which are functional structures. Only in exceptional cases should there be a radical removal of the facial wall of the antrum, removal of the naso-antral wall in the region of the inferior and middle meatus and removal of a portion of the middle and inferior turbinate bones.

The object of every surgical operation should be to leave the tissues in as nearly normal anatomic condition as possible. Empyema of the antrum should be treated as conservatively as possible, to reestablish the function of the antrum by opening the ostium maxillare and, when an operation is necessary, always to conserve tissues and not to create a large unnatural opening between the nasal and antral cavities. Such large openings become a constant irritant, allowing mucus and dust to enter the antrum and making it more difficult or impossible to effect a permanent cure. Such radical methods are warranted and necessary only in exceptional cases.

AN AID IN THE DIAGNOSIS OF MAXILLARY SINUS CONDITIONS*

By R. BOYD BOGLE, M.D., D.D.S., F.A.C.D., Nashville, Tenn.

IT is not my purpose to present a paper on diseases of the maxillary sinus but to report the findings in some cases difficult to diagnose. I am indebted to Fred E. Hasty, M.D., of Nashville, Tenn., for his valuable work and cooperation in solving some of the problems in maxillary sinus disease. These cases have been seen by Dr. Hasty and his suggestions and assistance merits appreciation.

These case reports reveal the fact that transillumination and the roentgen ray alone will not give the desired information as to the condition and content of the maxillary sinus; also that the posterior-anterior position does not reveal the true condition and that lateral roentgenograms are also necessary. To quote Dr. Hasty: "The lack of favorable results of the rhinologist and the dentist in dealing with cases of chronic paranasal sinus diseases at times causes embarrassment, and in the fullness of our ignorance, we have done much meddlesome surgery and dispensed misinformation."

The case reports to follow suggest not only the desirability but also the advisability of a complete general physical examination, including blood examination. The reports deal with a condition of the maxillary sinus termed polypoid or cystic degeneration.

*Read before the American Society of Oral Surgeons and Exodontists, Minneapolis, Minn., Aug. 18, 1928.

The following conclusions have been reached:

Absence of pus in the nose is not proof that disease of the maxillary sinus does not exist.

Irrigation of the sinus destroys the cilia so necessary to the well-being of the sinus.

The most satisfactory procedure as far as access and observation are concerned is the Caldwell-Luc operation.

"Opaque solutions can be used to a great advantage in the diagnosis of certain paranasal sinus conditions. The injection of lipiodol has been found to be the least painful, and, all things considered, the most satisfactory solution." (Hasty.)

Lipiodol is a preparation of the oil of poppy containing 40 per cent, by weight, of iodin. The iodin content makes the preparation opaque to the roentgen ray and it is also antiseptic. Lipiodol has a very pleasing effect when injected into a chronically diseased sinus. Injection once or twice a week has proved efficacious. The lipiodol remains for from four to six days and is not harmful if swallowed. It has been injected into the spinal column without untoward results. Sinuses are not always the same size in the individual, one side often being larger than the other. The antrum holds from 6 to 12 c.c. Injection is made into the antrum by a syringe, the nose being packed with moist cotton to prevent its

escape while the roentgenograms are being made.

The following case reports show the value of lipiodol in roentgenographic diagnosis of the maxillary sinus conditions.

REPORT OF CASES

CASE 1.—Mrs. A. Y., aged 46, who complained of irritation in the throat and a cough, had a large pedunculated polyp extending from the left antrum and swinging down to the base of the tongue. This was removed and at the time of examination, transillumination of the antrums seemed to be clear, perhaps transmitting light better than usual. A few days later, the left antrum was irrigated and about 6 c.c. of straw-colored fluid was drained out when the trochar was inserted. The irrigation solution was then used and returned clear. After the solution was drained out, lipiodol was injected. The remains of the sac of the polyp or cyst that was punctured with a trochar was distinctly outlined. At operation, a number of polypi were removed. The patient's teeth had been removed several years previously, and at the time the dentist felt that there was trouble in the antrum. The patient had not complained of drainage from the nose.

CASE 2.—Miss N. W., aged 30, complained of nasal catarrh and pharyngitis, both of which were worse on the left side. The left upper molar had been pulpless for some time. There was not anything in the nose that would indicate empyema. On transillumination, both antrums seemed rather dark, the left darker than the right. Roentgenograms showed that the left antrum was slightly cloudy and the mucous membrane apparently thickened. There were also shadows of what resembled a polyp, in the posterior portion. Lipiodol was injected, and the mucous membrane across the floor was found to be thickened.

CASE 3.—Mr. H. B. K., aged 56, complained of episcleritis of several years' standing. He had consulted eight or ten specialists, several of whom suspected that focal infection was an etiologic factor. The teeth and tonsils had been removed. On transillumination, the antrums transmitted light rather poorly, but since there was no history of recent drainage from the nose, pain, cough or other signs or symptoms usually found in paranasal sinus infection, serious consideration was at first not given to the sinuses. Later, the sinuses seemed to be darker, and, on roentgen-ray examination, little more information was gained than by transillumination. Irrigation failed to yield pus. After the injection of lipiodol, the roentgenograms revealed an irregularity of the posterior outer wall and floor of the right antrum. Under general anesthesia, a Caldwell-Luc operation was performed, and at least two large pieces of membrane a quarter of an inch thick were removed. After operation, the eye showed considerable improvement, but it grew worse after a severe cold. The end-results in this case are in doubt, but the technic as described revealed a pathologic condition that had not been previously determined. Results were good after eighteen months.

CASE 4.—C. C. M., a middle-aged man, consulted a dentist who removed three teeth and opened the antrum through the maxillary bone. The antrum was irrigated every day for two or three weeks, but the patient did not recover. The dentist advised him to have two or three other teeth removed anteriorly and another and a larger opening made into the antrum. A physician was consulted, and the patient was advised not to have any teeth removed but to consult a nose and throat specialist. The patient declined to have an intranasal operation and continued to have constant drainage into the nose and mouth for four years, when he finally decided to seek relief from rheumatism that had developed in the meanwhile. On examination, it was found that all molars on the upper left had been removed, with a great deal of the alveolar process. The antrum was very dark on transillumination. The roentgen ray showed a thickened mucous membrane of the sinus. Injection of lipiodol into the left antrum revealed that the central portion of the antrum was filled and that there was a filling defect in the walls of the antrum indicating a marked thickened mucous membrane. A Caldwell-Luc operation, performed under general anesthesia, revealed that the mucous membrane was about one-quarter inch thick in some places and there were many polypi. After eight months, the patient has some mucous drainage into the nose and the rheumatism has subsided.

CASE 5.—Mr. R. J. H., aged 22, had had the left eye removed at the age of 7 after an injury. Since one year after the removal of the eye, he had about once each year what

was considered by a competent ophthalmologist to be uveitis. Mercuric oxycyanid injections were administered during each attack. The vision was 20-100. It was impossible to see through the media. There were some deposits on Descemet's membrane, and a diagnosis of uveitis was recorded. Dr. Eugene Orr concurred in this diagnosis. The Wassermann reaction was negative. The tonsils were large and each contained an abscess filled with liquid pus. A devitalized upper left bicuspid tooth was found and an unerupted tooth lay across the root of the devitalized tooth. The tonsils, the devitalized tooth and the unerupted tooth were removed. The roentgen-ray report was as follows:

"The left antrum shows more density than the right and there is thickening of the wall. The right frontal sinus is smaller than the left and the central portion shows more density than normal. No clouding of any of the other sinuses was made out."

A diagnostic irrigation of the left antrum failed to yield pus. The improvement in the eye condition was slow, but after a period of time, it was possible to make out some details of the fundus. Numerous old choroidal spots could be seen. Recent inflammatory spots about the macula region could be made out. The Wassermann test was repeated and mixed treatment was administered. The milk injections were continued. After about three months, the eye seemed to have practically cleared up. The vision was 20-70. Immediately after an acute cold, the eye again developed a condition very similar to the previous one. Hilliard Wood, a rhinologist, was called in consultation, and he concurred in the diagnosis, approved of the management of the case and suggested that the left antrum be again irrigated. The antrum was roentgenographed, with about the same findings as at the first examination. Irrigation was again done and the solution returned clear. Mercuric oxycyanid was injected subconjunctivally, and mixed treatment was pushed to the therapeutic limit. After several weeks the eye cleared up, the vision being 20-100. After an acute cold, the eye reached practically the same stage as in the two previous attacks. Roentgen-ray examination revealed increased density in the left antrum, just as previously. Lipiodol was injected in the left antrum, and the roentgen-ray examination now revealed evidence of deformity in the floor and posterior portion of the left antrum.

To summarize: The left eye was injured by stab wound and the right eye developed trouble one year after removal of the injured eye. There was an average of one attack of uveitis each year, always treated by oxycyanid of mercury injections, with results satisfactory to the attending physician. Specific infection was fairly well ruled out by three negative blood tests and therapeutic treatment. Foci of infection were vigorously sought for and promptly removed when positively located. The antrum was irrigated on two occasions with negative results. Two competent consultants concurred in the findings and management of the case and felt that sinus surgery would not be justified. After the injection of lipiodol, the diagnosis seemed reasonably sure, but the amount of polypoid degeneration found in the antrum at operation was surprising. The patient denied a history of frequent colds and said he had not had a discharge from the nose or drainage into the throat nor had he ever suffered with neuralgia of the face. Suspicions were aroused by the lack of illumination, and by the increased density as demonstrated by the roentgen ray; but since irrigations were negative, surgery was not deemed advisable.

CASE 6.—Mrs. C. C., aged 25, complained of paroxysms of sneezing of more than one year's duration. On transillumination, the left antrum was perhaps a shade darker than the right. The roentgen-ray report revealed that, on the floor of the left antrum, there was an area of increased density involving about one-half of the sinus which resembled a tumor mass. Injection of lipiodol confirmed the fact that there was a tumor mass in the lower portion of the left antrum. The Wassermann reaction at that time was four plus. The patient was put on antisyphilitic treatment, and while it was not possible to repeat the examination, the physician in charge of her case stated that the patient was not having the paroxysms of sneezing and was enjoying good health. It has now been ten months since the original examination, and it is believed that if the tumor mass had been malignant, there would have been definite signs and symptoms before this time. Syphilitic involvement of the antrum has been seen in one other patient.

The injection of lipiodol seems to furnish an additional aid in maxillary sinus diagnosis and it is hoped that these case reports may cause others to try it and

develop its use to a point where it may prove of much value to the profession.

DISCUSSION

Howard C. Miller, Chicago, Ill.: We have been using lipiodol in a number of cases in which there is evidence of maxillary sinus involvement, and have found it most helpful in making a diagnosis. I call to mind one case in particular in which Le Roy Thompson, of Chicago, a rhinologist, was having difficulty in the treatment of an acute eye infection. The patient gave some symptoms of acute maxillary sinusitis, but all the usual diagnostic aids of determining the presence of disease were negative. Lipiodol was injected and, on examination of the roentgenograms, a radiolucent area surrounded by the radiopaque lipiodol was found which apparently was a cyst involving the sinus. The diagnosis was confirmed by an operation in which a large cyst was found within the sinus and removed, with a normal recovery from all previous symptoms. It has proved of distinct value in several other cases which were somewhat obscure, and I believe it will become a valuable aid in the diagnosis of chronic sinus involvement.

A. B. Vastine, Danville, Pa.: We have done a little work with the lipiodol and probably will use it more in the future. Our reason for not using it in this connection is that, with the use of diagnostic irrigation, diagnosis of these obscure conditions of the maxillary sinus can be arrived at. We have found by diagnostic irrigation that pus is not present in certain types of maxillary sinus involvement; therefore, we cannot make an accurate diagnosis by mere irrigation with a clear fluid. We usually use a dye. This gives an idea not only of the content of the sinus but also of the functional activity. I have the first pathologic maxillary sinus case yet to deal with in which the function of the ostium is normal. When there is disease of the sinus, ordinarily the functional activity of the cilia is first involved, then there is interference with normal drainage at the ostium. The waving motion of the cilia toward the ostium tends, in infection, to some involvement of the ostium. By injecting with a dye, such as a very weak mercurochrome solution, on the clear or uninvolved side at the sitting at which the other or normal side is injected, there will be found a difference in function; that is, in the comparative rate of emptying even though no content be present. This functional test combined with use of the intra-oral roentgenogram usually enables one to make an accurate diagnosis in probably 99 per cent of maxillary sinus cases. For the diagnostic irrigation, we have found that usually there can be located in a pathologic sinus of dental origin some point of intra-oral entrance where, with a 22-gage needle, a diagnostic irrigation can be done. I would like to have Dr. Bogle tell us how he does diagnostic irrigation and also how he introduces lipiodol. I believe that some aspects of the problem of polypi in the intranasal passage have been overlooked. Dr. Bogle has most beautifully brought this out, especially in asthmatics in whom intranasal clearing has been done and no attention was paid to the same intrasinus condition.

Boyd S. Gardner, Rochester, Minn.: Occasionally, one finds a fistula in which there is a question as to just what tooth in involved. The fistula can be injected with lipiodol and then, with the aid of the roentgen ray, it is very easy to make a diagnosis. We have found this idea to be of exceptional aid especially around upper molars. Lipiodol is used in making diagnoses of spinal cord tumors, with no bad after-effects. Accordingly, we should not hesitate to use it in oral work.

Theodor Blum, New York City: Dr. Bogle's paper was quite timely, especially to those of us who may not have known about this new diagnostic method. But it brings up another very important point, one which I have stressed many times: whether we, as oral surgeons and exodontists, have a right to treat the antrum, unless it has become diseased through the teeth or through some disease of the maxillae. I never touch an antrum unless it has become diseased through the channels which I have mentioned. Even if the antrum has become diseased through the two channels that I have mentioned, I will not operate on it unless I have had a complete diagnosis of the condition of the sinuses, especially on the same side. I have often heard dentists and oral surgeons complain about a nose and throat man operating on a cyst which originated from the teeth, and I think these men were justified in their stand, because dentists and oral surgeons are much better equipped by knowledge and experience to operate in these cases. We should show the same courtesy toward the nose and throat specialist, as even from an

anatomic standpoint, the maxillary sinus is not in our field. It is part of the nose, and it comes into our sphere and our field of work only if it has become diseased through the teeth or the maxilla. In using this method of injection, one has to be just as careful as with the ordinary irrigations of the antrum for diagnostic purposes. The large cyst that Dr. Miller mentioned could just as well have been injected with lipiodol through the lateral wall if the wall of the cyst had been close enough to the lateral wall of the nose. All these methods are to be handled with discretion as much as some of the other things that we have avoided in the last few years. Personally, I feel that there is not so much need for this injection, especially in our own work, and I do not think that I shall use it.

Sterling V. Mead, Washington, D. C.: Lipiodol is of the most use in a chronic hyperplastic sinusitis or a cyst of the sinus. George H. Trible, a rhinologist, of Washington, has done a great deal of work with lipiodol, and many of our other specialists in Washington have done a good deal. Dr. Trible has an article in *International Clinics* on the use of lipiodol, which he has tried out in all kinds of difficult cases. I believe that it is a useful adjunct to our methods of diagnosis of sinusitis, but I do not believe it is a sure diagnostic measure in all cases. There is no one diagnostic agent that is infallible. Each one has its place. If we have a suppurative sinusitis, we shall be able to determine this fact usually from the symptoms. Transillumination is very valuable in a suppurative condition, and roentgen rays are valuable in some cases. But we lose sight of a very important diagnostic point. A sinus may be negative to transillumination and the roentgen ray, and the ordinary diagnostic measures, and even negative as far as the lipiodol is concerned, and still we may have a pathologic process. I have seen a number of cases in which there was a chronic osteomyelitis or chronic osteitis along the floor of the sinus in the tuberosity region and even a small intra-oral film was not positive. It is possible to have a residual infection that it is hard to detect in some cases, impossible to detect by any of our diagnostic measures. I have in mind two or three such cases that were negative to every test. We must not lose sight of symptom diagnosis. Tonsils may be negative except on symptom diagnosis. Some of these sinus conditions have to be determined on symptom diagnosis. I agree with Dr. Blum that the dentist and oral surgeon is much better off if he does not have anything to do with the operations about the maxillary sinus and treatment except in the way of cooperation. In Washington, we have a happy solution of this problem, and there is the utmost cooperation between dentists, oral surgeons and rhinologists. It is more satisfactory all round when sinus conditions are handled in this way, not only in diseases of the maxillary sinus, but also in many of these troublesome cases calling for closing openings into the sinus. If we simply suture these areas, and leave the sinus alone, allowing the secretions to seep down, without the cooperation of the rhinologist, many of these cases are doomed to failure. Lipiodol is also useful in the case of ranula. In an attempt to determine the extent of the condition, the injection of lipiodol is a valuable adjunct, as well as in these sinus troubles that Dr. Gardner has pointed out.

V. W. Dedon, St. Paul, Minn.: I have been using lipiodol for about six months for different purposes, and when we have a chronic sinus, perhaps a fistula in the mouth, and are trying to determine just what is taking place in that sinus, lipiodol shows us very readily. If we soak gauze in lipiodol, pack the sinus that we have operated on and make a postoperative picture, it is of interest to see the results.

THE VALUE OF ROENTGENOGRAPHIC INTERPRETATION IN ORAL DIAGNOSIS*

By HOWARD C. MILLER, D.D.S., Chicago, Ill.

THE object of this presentation is to consider the value of the roentgenogram and its interpretation in oral diagnosis, and not to deal with the various technical procedures necessary in its production.

While the technic of producing a correct roentgenogram is a subject of great importance and one which should be discussed by roentgenologists who are experts in this field, too much emphasis cannot be placed on correct interpretation and correlation of the findings with clinical signs and symptoms. Those who are interested in acquiring this technic should consider carefully all phases of the work in order to obtain complete knowledge of what constitutes correct roentgenograms and their production.

What may be considered by one a correct or satisfactory roentgenogram may prove unsatisfactory to another. This permits each operator individual variations in his technic, but at least these variations should be based upon a standardized technic which will permit dependable comparisons between the films he makes, either from one to another in the consideration of a complete case or in the progressive or destructive changes of surrounding structures in those made from time to time.

An acceptable roentgenogram should show clearly all the structures which are of interest to the dentist, registering on the film the density or the radiopacity or radiolucency of the dental tissues; tissues which are translucent to the roentgen ray registering black on the film and being known as radiolucent, and those which are opaque to the rays registering white on the film and being known as radiopaque. Each variation in density should appear in a film that is clear of texture, all possible value and contrast being obtained by proper exposure, development, washing and the production of a film that is neither too dark nor too light.

It is generally agreed that the intelligent use of the roentgen ray is one of the greatest aids in oral diagnosis. To use the ray intelligently means never to depend on roentgenograms alone for a diagnosis. The acceptance of roentgenographic findings without further substantiating evidence, such as the history and clinical findings, has led to frequent errors in arriving at a diagnosis, which is essential before a correct prognosis can be made or corrective measures carried out. Roentgenographic interpretations of a laboratory are many times accepted by a dentist as a diagnosis, or a diagnosis is arrived at by the dentist himself reading the roentgenograms without proper consideration of other factors.

All radiolucent areas may not be pathologic. In the study of the anatomic landmarks found in and about the oral cavity, several of these normal areas will appear radiolucent in the roentgenogram

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and may be mistaken as pathologic. In the upper jaw, the maxillary sinus or antrum, which usually appears dark or radiolucent above the molars and bicuspids, in some cases extending as far forward as the cuspid and lateral incisor, may be mistaken for a cyst or an abscess. Many times, from its appearance in the roentgenogram, the antrum is believed to be involved by a granulomatous area at the root ends of the upper molars. This is due to the dipping down of the sinus between the buccal and lingual roots, when in reality the roots do not penetrate the sinus at all, and if the pathologic area is carefully removed, the membrane in the floor of the sinus may be left intact.

The nasal cavity appears as a dark area above the superior incisors and is divided in half by a white dividing line of radiopacity. The anterior palatine foramen appears as a dark area above and between the superior incisors, and sometimes, this depending on the angle at which the roentgenogram is made, this radiolucent area will be thrown about the apices of one of the incisors, and in this position is frequently mistaken for a pathologic condition.

Dark areas appearing above the lateral incisors are often mistaken for areas of bone destruction, but are due to the presence of thinner plates of bone in this region and to the rays passing through the nostrils readily and darkening the film at that point.

In the lower jaw, the appearance of the mental foramen below and between the lower bicuspids is frequently mistaken for a pathologic condition of these teeth.

The mandibular canal which is seen as a broad dark line extending from the mandibular foramen through the body of the mandible along the apices of the lower teeth to the mental foramen is sometimes varied in form and may be mistaken for an abnormal condition. The mandibular foramen which appears as a dark spot on the ramus, and an area of osteoporosis in the region of the angle of the jaw, appearing as a large dark area, are sometimes mistaken for bone destruction.

The incisive fossa also permits a greater penetration of the rays and a dark area is produced which may be mistaken for a bone change.

Other normal anatomic landmarks appear as radiopaque areas and are mistaken for impacted third molars, broken root tips and various forms of abnormal formation. A normal area that appears abnormal in many cases is the coronoid process of the mandible, which appears as a radiopaque area on the upper jaw and is mistaken for an impacted upper third molar. The external oblique ridge often obscures the apices of the lower third molar, and when a film is made with the rays directly through an impacted lower third molar, will make the tooth appear as though completely covered with bone; whereas, on direct examination, the crown will be found exposed, which makes its removal a much more simple surgical procedure than would appear from the film. The lingual tubercles may appear as small white areas immediately beneath the lower incisors, and may be mistaken for condensed bone or supernumerary teeth. The malar bone appears as a white area and many times obscures the apices of the upper molars.

In order to prevent misinterpretation, all dentists should have a broad knowledge of the subject and should know the anatomy of the region involved in the roentgenogram and be able to recognize the many normal anatomic variations. The importance of properly made roentgenograms taken at different angles in order to determine whether or not the area shown is normal should be recognized.

If the dark or radiolucent area bears the same relationship to the tooth in each subsequent roentgenogram made at different angles, it may safely be considered as due to a pathologic condition. On the other hand, if the area bears a different relationship to the tooth in each subsequent roentgenogram, the area may be considered a normal space or anatomic landmark. The vitality test is another aid in determining whether or not these areas are pathologic, and the history and clinical symptoms are always necessary to complete the diagnosis.

Pathologic conditions which cause radiolucent changes in the roentgenogram are pericementitis, periapical disturbances, diffuse periapical absorption, cysts, osteitis, necrosis, osteomyelitis, alveolar absorption and caries. Conditions which produce radiopaque changes are osteogenesis, sclerosis, hypercementosis, pulp stones, deposits of calculus in ducts of glands and sinus involvement. The ability to recognize the roentgenographic appearance of all these conditions is essential to complete a correct oral diagnosis.

Although much has been written and presented in various forms dealing with these conditions, it is frequently astonishing to note the lack of careful consideration of these factors in cases that are presented for treatment. Many times, this is due to a hurried or careless reading of the roentgenogram, poorly made roentgenograms, or the fact that there are an insufficient number of films to show the condition from various angles. Probably one of the commonest causes is the acceptance of the report of a laboratory which has been written long after the departure of the patient, with no thought of examining the mouth or considering the history of the case. A laboratory report should contain only information regarding the density of the surrounding structures which departs from the normal, such as periapical destruction, impacted teeth, caries, extensive alveolar destruction and any variation from normal anatomic relation, and should be accepted as such by the dentist, the final decision as to treatment being reached only after the correlation of all factors.

Since the discovery of the roentgen ray, advancement has been rapid in this field. However, its use should not exclude the older methods, such as inspection, palpation, percussion, determination of response to thermal change, history taking and the interpretation of the various subjective symptoms of pain. To diagnose a case is to determine scientifically the distinctive nature of a disease or ailment by its symptoms, and to discriminate as to whether or not the condition is that of health or disease; all of which is imperative before proper treatment can be instituted, as a true diagnosis is the basis of all treatment.

A true oral diagnosis can be made only by the correlation and consideration of the past history, history of the present disability, clinical findings, roentgenographic findings, not only of the remaining teeth but of all edentulous areas as well, vitality tests and any other diagnostic means that may aid in affording a true knowledge of the conditions presented. Often, cooperation with the physician is imperative in order that his opinion and interpretation of general conditions, laboratory reports, etc., may be combined with that of the dentist, and by complete consideration of all factors, the patient will receive the greatest benefit.

The decision as to what must be done with teeth that may be considered questionable from a systemic standpoint is difficult and the problem is at the present time causing much discussion within the profession. It is not difficult to reach a

decision regarding those teeth that are definitely bad from a dental standpoint, such as teeth showing extensive periapical destruction, impacted teeth, pyorrheic teeth where attachments are extensively destroyed, teeth that are badly broken down or decayed, making restoration impossible, and those that it may be necessary to remove from a restorative standpoint; but it is in the consideration of the nonvital teeth that are negative or nearly so to roentgenographic findings and which can be condemned only on their possible relation to systemic disturbances, that the responsibility of the decision becomes much greater. The final decision should be reached only after careful consideration of all physical conditions, such as systemic disturbances, age, and all general findings, in cooperation with a competent physician. This classification of conditions was first advocated by the Mayo Clinic. Many times, it is better to explain all possibilities to the patient regarding the questionable teeth, inform him of the present-day knowledge regarding the same and allow him to assume some of the responsibility of the decision. Perhaps in the future, further definite evidence sufficient to eliminate all doubt regarding these questionable teeth will be brought out, at which time all responsibility may be accepted by the oral diagnostician. With present-day knowledge, however, this must be shared by the patient, physician and dentist, and based upon all possible methods of diagnosis and sound surgical judgment.

It must be remembered that oral roentgenography is of very little value in the diagnosis of disturbances of the teeth and jaws which have not caused sufficient bone destruction to show definitely through the more compact and thick alveolar plates of bone and tissues, as in the case of death of the pulp which has occurred too recently to show destruction of the periapical tissues. In these cases, the vitality test, as carried out with the improved electric vitality testers of today, is invaluable, and its use is, in many cases, more certain than roentgenography. No report is complete without investigation of the vitality of each tooth by all diagnostic aids, with which each dentist should be familiar.

As in other diagnostic aids, the vitality test has its limitations, as those teeth which have a considerable amount of secondary dentin present may respond weakly, even though vital. Teeth containing pulp stones will also be affected in the same way. In multirooted teeth, a weak response may be elicited even though the pulp may be destroyed in one or two canals, the remaining vital portion giving the reaction. Teeth with large metallic crowns cannot be tested without the removal of the crown; but, in spite of these limitations, the vitality test has its definite place in oral diagnosis.

It is not with any thought of discrediting the use of the roentgenogram in oral diagnosis that the limitations which must be placed on it have been pointed out, but with the hope that its proper use will emphasize the need for making a roentgen-ray examination in all cases in which a complete diagnosis is desired of all conditions that may exist in the mouth.

In the building of full dentures, to the many records such as various facial measurements, length and alinement of the teeth and other data recognized as essential, should be added a complete set of oral roentgenograms, inspection of which will disclose remaining root particles, unerupted teeth, areas of residual infection, cysts, sharp bony projections and remaining particles of filling material that may have become lodged within the tissues; which may interfere with the comfortable

wearing of the dentures and may become a source of trouble and embarrassment later on. In the field of partial restorations, a careful study of all remaining teeth in the mouth, especially the abutment teeth, is most imperative. Also, there is to be considered the condition of all edentulous areas that are to be restored, and in no better way can these important factors be considered in planning a restoration than by a complete set of oral roentgenograms.

Patients should be impressed with the necessity of making a complete set of roentgenograms before an intelligent diagnosis can be made of conditions within the mouth. It should be emphasized that cavities are more easily found which are hidden from view, and which, by the usual method of inspection and exploration, might be overlooked until decay had progressed too far; that the condition of the roots is shown and, if destruction is taking place, the extent to which it has progressed in the bony structures surrounding the teeth. Explain that it reveals the extent of pyorrhea pockets and assists in determining the amount and type of treatment necessary; that it reveals unerupted or impacted teeth, broken root particles and any abnormal conditions that may fail to appear on the surface of the surrounding tissues. Many patients believe it useless to have a roentgenogram of a tooth that is to be extracted, but when it is explained that it shows the position of the roots and extent of bone destruction resulting from infection, all of which enables the dentist to better complete his work, they will usually agree.

Many dentists depend on others to make their roentgenograms, feeling that those who have made a study of all technical phases of the work are better able to produce them; and they therefore refer their patients for service of this type. It must be remembered that the fee charged for the making of these roentgenograms is a technical fee for producing the same, and that, in the majority of cases, these pictures are of no value without the correlation of all factors. The roentgenograms are sent to the referring dentist, and after he has examined them, with due consideration of all other factors, and has given an intelligent report of conditions and possible treatment, he is entitled in every case to a fair fee for this service, whether or not the patient is to have the work done. This is true of all like services given by the physician, lawyer or any other professional man whose services are granted under similar conditions. When the dental profession as a whole accepts this practice, the opinions and consultations given every day to thousands of patients will be looked on with more respect. The fee for such service necessarily must be based upon the locality of each practice, the type of patient and the ability of the patient to pay.

If dentists will interpret oral roentgenograms in the same manner that the physician interprets roentgenograms in other parts of the body, i. e., in conjunction with all clinical signs and symptoms, not only will the patient be unmeasurably benefited but there will also be fewer errors in the treatment of oral conditions.

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DISCUSSION

A. P. Williams, Louisville, Ky.: The concept that too much emphasis cannot be placed on correct interpretation and correlation of clinical signs and symptoms is the foundation of oral diagnosis. Dr. Miller most aptly voices a request for an acceptable, correct and satisfactory roentgenogram and that should be the initial step. An acceptable dental roentgenogram should show clearly all structures that are of interest to the dentist. I con-

sider it important that we have some sort of guide or rule in mind as an index as to whether or not a film is acceptable for interpretation, and I know of no better guide in this respect than the consideration of the dentino-enamel cap. If the roentgenogram reveals a very definite contradistinction between the enamel and the dentin, we may rest assured that we have good detail and an acceptable film for comparison. Dr. Miller has brought out most adequately the differentiation of anatomic landmarks as found in the oral cavity. The many normal anatomic points from both a macroscopic and shadowgraphic point of view must be known before we can conceive of any deviation from the normal. Relative to Dr. Miller's statement that when a film is made with the rays directly through an impacted lower third molar, the tooth may appear as though completely covered with bone, whereas, on direct examination, the crown may be found exposed: I wish to emphasize this statement to some extent. Fundamentally, we must not lose sight of the fact that roentgenograms are merely shadowgraphic representation of tissue and a slight deviation of the ray will cause the object to appear in gross disproportion. To obtain a normal roentgenogram of a lower third molar, the third molar should not be taken as an index of normal, but a normal representation of the first and second molar. The film should present a normal enamel cap of the first and second molar and a normal contact point between the first and second molar. The third molar will then be shown in its true position. This is the only means by which the proper relationship of the third molar and the surrounding osseous tissue can be definitely ascertained. Dr. Miller has also considered fees, and I would feel remiss if I did not emphasize the fact that the making of roentgenograms is but a technical procedure and the resultant films are valueless, without the knowledge of the dentist in his interpretation and the correlation of all factors entering into diagnosis. To be a self-respecting professional man, we must place a value on our services or diagnosis, and we must charge a fee for our knowledge, judgment, and experience. Comparatively speaking, when I consult my attorney I expect to pay him for an opinion. I do not expect him to present me with Blackstone or the last revised issue of the statutes, but to render me an opinion of his correlated knowledge; and he charges me a fee for that opinion, regardless of whether it may prove right or wrong. I have paid the price of a wrong opinion, but at that I have not lost my respect for my lawyer. The lawyer who is giving free advice is not successful; no more so the dentist.

THE SURGICAL TREATMENT OF PYORRHEA ALVEOLARIS*

By FRANK S. KAISER, D.D.S., Los Angeles, Calif.

THE slogan of the American Dental Association is that dentistry can add ten years to your life. That expresses an ideal which is not beyond our limitations, if we, as dentists, will recognize our responsibility to our patients and to the profession to which we are all proud to belong. But are we doing our part when we ignore the possibility of focal infection in the gingival areas? The time is here when we must concern ourselves with the systemic welfare of our patients. After hearing Dr. Gardner's lecture in his recent tour of the country, we must now admit, if never before, that we, as dentists, have a responsibility which is recognized by an enlightened and conscientious minority among the

*Read before the Section on Orthodontia and Periodontia at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 23, 1928.

profession; but not until we all realize it can we be rightly considered as practicing one of the healing arts, and as being helpful to humanity in general. Dr. Gardner said that we are responsible for three links in the chain of ten, namely, gingival infections, apical infections and cysts. Do not let us forget any of our links, nor fail to refer our patients to the physician in order to check up on the other links.

Periodontal infection is generally conceded to have two main predisposing causes: first, local; second, systemic. Either or both may be present. No matter what the predisposing causes may be, there is a local condition which must be taken care of, such as calcareous deposits, fibrosis and, in bone involvement, sharp spiculae. In order to solve the systemic problem, the patient should be referred to a diagnostician to have a thorough physical examination, and through consultation and cooperation with the physician, whatever the etiology, the dentist is in position to cope with the condition adequately. And we must not overlook the fact that the physician is dependent on the dentist to do his part well. With many of our patients, it is a matter of their being dependent on us for their health.

Aside from the local causes which you have heard enumerated for years, such as poor dentistry, calcareous deposits and trauma, there is yet another problem with which we have to cope, and that is a lowered tissue resistance with a resulting lack of attachment of the soft tissues, accompanied by round-cell infiltration. These tissues suffer infection and cannot combat it; therefore, we must remove them. The point I wish to make here is that traumatic occlusion, instead of being the cause, is, many times, only a result. Without first eliminating the original cause of trauma through bringing about the regeneration of new alveolar crest fibers and transeptal fibers, grinding such teeth will actually make the condition worse. Aside from the facts just developed, there is another major consideration, namely, the pathologic condition of the bone. You will recall that, when there is bone involvement, the periosteum is absorbed, together with the cortical layer of the alveolar process, leaving a spiculated concavity or, in other words, an osteomyelitis.

Where gingivitis is present, proper prophylactic measures will suffice, as the condition is not chronic and the gingivae may respond readily. In chronic conditions, where scaling technic has been used and failed, and the conditions are advanced to a stage of bone destruction, or focal infection is a serious consideration, as determined by the physical examination, time is a paramount factor, and the infection should be eliminated not only thoroughly, but also as promptly as possible. Whether the case is treated surgically or not, it is necessary to give the patient a course of instruction on tooth brushing and taping technic, and only after he has learned to take care of the teeth and gingivae, and has had the masticatory apparatus put into proper balance, will he be in position to guard against a recurrence. Procrastination in the treatment of gingivitis will mean pyorrhea.

Roentgenographic examination should be made in all cases of ginivitis, as in pyorrhea. Many times, involvement will be found when not expected. I believe also that before one can read roentgenograms intelligently, he must himself perform, or have seen, several débridements. Then only can he comprehend the actual conditions shown; and even

then he may be misled at times. It is preferable, of course, not to wait until the case is advanced to the stage where it is just possible to save the teeth, and therefore get a result which is not esthetic. Early diagnosis by the general practitioner may prevent a débridement; so to those of you who prefer conservatism, I say: Let us get together, radicals and conservatives, and preach early diagnosis to the dentists and preventive dentistry to our patients. And one thing more: Let us agree that there is room for all measures where indicated.

In performing a débridement, strict surgical technic should be employed

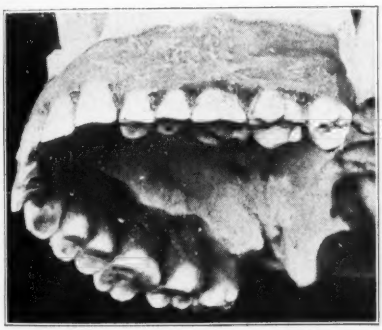

Fig. 1.—Case before operating.

throughout. The patient should be prepared as for any surgical operation; not that we wish to infer that it is possible to operate in a purely aseptic manner in a mouth which is infected, but the more careful one is, the less the danger from a cross infection. If an operator is accustomed to handling all types of oral infection, I believe that it is necessary to use rubber gloves during the operation, as they can be sterilized thoroughly, and after one becomes accustomed to them they are not a hindrance to the touch, as claimed by some, but, to the contrary, are a positive benefit, for they insulate the fingers so there is no contact with the hemorrhage, thereby increasing speed in operating.

In order to minimize any reaction from a débridement, a bacterial examination is made in every case, and, by so determining the nature of the infection, we may take steps to sterilize the areas temporarily before any operative work is begun. Where streptococci are present, one should be careful to proceed slowly in order to build up resistance by the formation of auto-antitoxins. In Vincent's infection, all cases are treated until the clinical symptoms have disappeared. It is not possible to eliminate all Vincent's organisms from a mouth when there are pockets in the soft tissues where the bacteria hibernate and flourish, but the mouth should be cleansed superficially, at least, before any surgical work is begun.

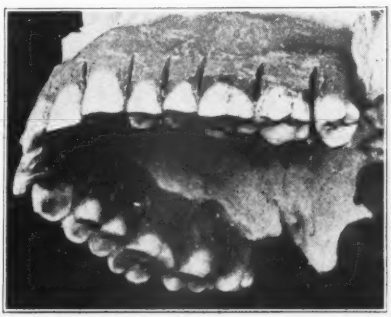

Fig. 2.—First step. Incisions are made with interproximal curettes to the depth of the pockets from the buccal to the palatal aspects.

Clotting and bleeding time are taken, and in cases of prolonged clotting time, an injection of coagulen, hypodermically, will hasten the clotting.

When local anesthesia is decided on, the conduction method should be used

so that there is no danger of spreading the infection by making an injection into an infected area. When patients are extremely nervous and dread the operation, the case should be hospitalized and some form of premedication used, such as morphin, one-fourth grain, atropin, one-one hundred fiftieth grain, hypodermically one-half hour before the operation; or hyoscin, morphin (one eighth grain) and scopolamin (one-two hundredth grain) hypodermically one-half hour before the operation; or, in extreme cases, hyoscin, morphin (one four grain) and scopolamin (one-one hundredth grain), one and one-half hours before, followed by hyoscin, morphin (one eighth grain) and scopolamin (one-two hundredth grain) one-half hour before the operation. Either of these premedications will create a relaxed condition, which will enable the operator to work under the most favorable conditions, and the patient will have only a vague recollection of the work done.

The débridement consists of a thorough removal of all loose and infected tissue from around the teeth, down as far as healthy alveolar process; as well as gross scaling. The process is curetted by means of approximal curettes and bone hoes until it is continuously smooth around and between all of the teeth. The approximal curettes, as advocated by A. W. Ward, are made with teeth so coarse that they will not cut healthy bone, but merely curette the necrotic bone and smooth off the spiculae that are present.

The bone, as well as the soft tissues, should be trimmed so that there are no pockets, the removal being carried to a point where only normal tissue exists. A pack of zinc oxid, eugenol, rosin and asbestos fiber is applied to all of the operative areas and allowed to set. This is trimmed so that it does not interfere with the occlusion, and the patient is dismissed with the pack in place.

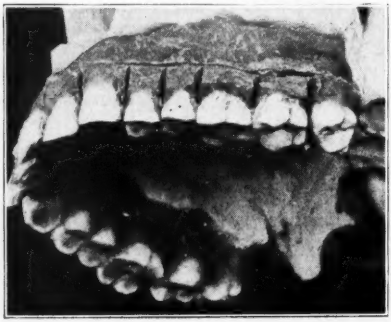

Fig. 3.—Incisions connected at the bottom of the pocket.

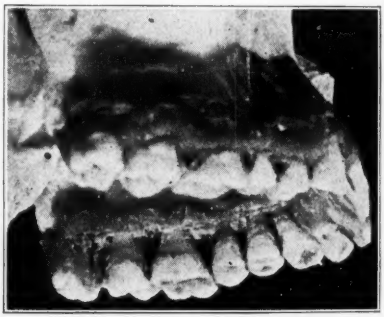

Fig. 4.—Soft tissue and bone removed to the depth of the pocket.

The patient is put on a diet of liquid and soft foods for an ordinary case, but when it is desired to cleanse the alimentary tract and blood in a complicated case, a balanced diet is prescribed, consisting of milk, orange juice, beef bouillon and tomato juice.

After a week or two, the time depending on the case, the pack is removed and

the curetted bone will now be covered with a thin layer of connective tissue. This new tissue gradually thickens, and is later covered by epithelial tissue which is normal. After these tissues become firm, the case is scaled thoroughly, and investigations are made for any irregularities in the occlusion, which are relieved where necessary; after which the entire case is polished. The sensitiveness, which is not a paramount factor, is taken care of first by the application of the pack, and, secondly, by teaching the patient to cleanse the teeth thoroughly by the use of dental tape and the toothbrush immediately after the pack is removed. In extreme cases, the teeth may be treated in the office with zinc chlorid, together with a mouth wash containing zinc chlorid for home use.

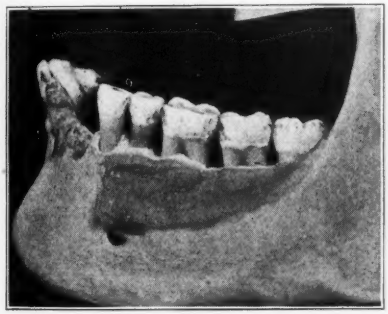

Fig. 5.—Mandible curetted; showing elimination of pockets.

Fig. 6.—Case packed with "wondrpak," a surgical cement, buccally and palatally.

The question is often asked, "Does regeneration of bone result after débridement?" As I have been interested in this phase of the work, dozens of patients have been operated on in whom teeth were present which, it was taken for granted, would have to be extracted later. In a case with bone involvement, you will recall, the periosteum has been absorbed together with the cortical layer of the alveolar process as well, a spiculated concavity being left which is irritating to the soft tissue. After thorough curettement, it is found, up to the present writing, that no new bone has been formed, but the periosteum has grown over and covers the curetted process, which is the result obtained when a tooth has been extracted. The new tissue is firmly attached to the periosteum, and a normal condition again prevails, with the exception that the process is lower than originally.

If there is any one present who is not in accord with this work, let me say that I was not in accord with it when it was first called to my attention, in 1922. My early conclusions regarding the work may be attributed, first, to lack of information, and, secondly, to timidity. I watched cases of débridement for about a year before attempting the work, but after trying it out on my worst cases, I gradually arrived at the point where I became a strong advocate of the method. It may interest you to know that I have had many complete recoveries from many systemic diseases where no other focal infection was present

nor had been previously eliminated, and I am sure that when you become familiar with the true possibilities of this technic, you will become as enthusiastic as I am.

EFFECTS OF TRUE INFANTILISM ON THE JAWS AND TEETH: A CASE REPORT*

By IRWIN F. STEUER, D.D.S., Cleveland, Ohio

IN seeking material for the study of the condition of the teeth and jaws of people suffering from endocrine dysfunction, the following interesting case was brought to our observation. This case is sharply defined from others in that we have a comparison of the endocrine victim with a so-called normal sister.

Often the diet is thought to be a predisposing cause of endocrine disturbances, but in this instance, diet can be ruled out, for the children had always lived together and had eaten the same food.

The patient, an Italian girl, aged 14, with the facial expression of a girl of 6 or 8 years, was undersized, with a disproportion of the body in that the upper and lower extremities were very thin. There was marked lordosis of the spine and a concavity in the upper dorsal portion. The head was about normal in size; the nose was not contracted; the neck was short, and the lower jaw was small and pointed.

Both children were born in this country, but were removed to Italy when 2 years old and again brought back this year. As a result, neither could speak English, and it was very difficult to make a fair Binet-Simon test. This test showed the patient's mental age to be that of a child 7 years old. Her performance age, which was of more importance to us, registered her as a child of 8½ years.

The skin was dry and showed normal pigmentation; the hands and feet were warm. The hair on the head was dark brown and normal in texture, and very

Fig. 1.—Left, normal 12-year-old girl; right, the patient, her sister, aged 14, showing their comparative heights.

scant on the eyebrows, and there was none on the pubes, face, axillae, chest or extremities. Subcutaneous fat was abundant over the abdomen and trunks, with small deposits on the mammae but no fat on the extremities. The bone system was tender and the muscle tonus poor.

A roentgenogram revealed that the sella was unusually small, and the hands showed no evidence of fusion of the epiphyses. There were seven carpal bones present, and the eighth, the os piciform, in the process of formation. The ossifica-

*From the Department of Orthodontia, Northwestern University Dental School, Chicago, Ill.

tion did not seem to be more advanced than that of a 7 or 8 year old child.

The measurements of the 14-year-old girl as compared to those of her normal 12-year-old sister are given in the accompanying table.

COMPARATIVE MEASUREMENTS OF PATIENT AND SISTER

	Patient	Sister
Standing height	47¾ in.	54 in.
Sitting height	23½ in.	28 in.
Reach of arms	45¼ in.	54½ in.
Breadth of shoulder	23 cm.	28 cm.
Breadth of pelvis	19 cm.	23 cm.
Weight	57 lb.	70 lb.

The ratio of her sitting height to the standing height is entirely pathologic. That of the standing height to the reach of the arms is infantile.

The patient showed a high sugar tolerance, a symptom of hypopituitary disease. Menstruation, which begins earlier in Italian children than others, had not been established.

As a result of laboratory and roentgen-ray tests, together with a careful study of the findings, the case was diagnosed as true infantilism of pituitary origin.

As tooth formation is a modification of bone formation, one would expect to see quite an influence on the teeth as a result of this glandular dysfunction.

This case is quite in harmony with descriptions of other cases of hypopituitarism, in that there is present a slight maxillary prognathism, sharpness of the mandible, overlapping of the central incisors, which are larger than the average, and retardation in eruption of the remaining teeth. The lateral incisors are below the average in size, as compared to those of the normal sister. There was a slight tendency to crowding of the lower anterior teeth.

Fig. 2.—Left, teeth of normal 12-year-old girl; right, teeth of her sister, aged 14, who is affected with infantilism.

There are present in all sixteen teeth, nine lower and seven upper, as contrasted to the twenty-eight teeth that should be present in normal dentition. On the right side the following (permanent) teeth were present: below: first incisor, second incisor, cuspid and bicuspid; above: first incisor, second incisor and first molar.

On the left there were the following teeth (permanent): below: first incisor, second incisor, cuspid, first bicuspid and

first molar; above: first incisor, second incisor, first bicuspid and first molar.

Lack of care was evidenced by the great amount of calculus and by a severe gingivitis. The tongue was rather large for the patient's size.

Roentgen-ray examination revealed that:

1. The development of the teeth was that of a child of about 10 or 11 years.
2. The third molars were not being formed.

It is quite surprising to know that the only tooth showing any decay was the upper left molar, which was covered to a great extent by salivary calculus.

The upper arch is small and tends toward squareness. From the cuspid region, anteriorly, the arch becomes extremely narrow, and is not large enough to accommodate the teeth present.

This development might be regarded as having reached a certain stage and then having suddenly come to a standstill, a feature which is supposed to be characteristic of the whole physical development in pituitary infantilism.

Fig. 3.—Above, models of the teeth of normal 12-year-old girl; below, models of teeth of her sister, aged 14, who is affected with infantilism.

3. The lower first permanent molar had been extracted.
4. The upper left molar showed a lack of bony development.
5. There was a decided lack of root formation of the cuspids and bicuspids.

I wish to acknowledge the aid of Drs. Roney and Hutchinson, who diagnosed this case, which was seen at Northwestern University Medical School.

INTERESTING CASES OF ADVANCED PERIODONTOCLASIA BEFORE AND AFTER TREATMENT*

By THOMAS B. HARTZELL, M.D., D.M.D., F.A.C.D., Minneapolis, Minn.

THE subject assigned me may be treated in such a variety of ways that I find it difficult to decide the number and type of case to discuss. The reason for my dilemma arises from the fact that periodontoclasia, particularly that type in which pyorrhea is the chief characteristic, depending as it does on the vigorous action of pyogenic cocci, dwelling for the most part on the surfaces of the teeth, and invading the surrounding tissues from those surfaces, not infrequently involves actually large areas of ulcerating surface. Take, for instance, an advanced case, in which there is an average depth of pocket of a quarter of an inch on all the teeth, and here there would of necessity be present the equivalent of approximately 7 square inches of ulcerating surface from which the tissues themselves, the lymphatics, the veins and the blood stream can be, and are, invaded. In such a situation as I have pictured, frequently existing all unknown to the physician and, in many instances, to the dentist himself, we have the potential for a great variety of injuries to heart, joint, kidney and nerve tissues and their coverings; stomach and intestinal surfaces, and blood cells. In my own experience, running back over thirty years, I have been impressed by the fact that I have seen more secondary anemias in individuals of the type above mentioned than anemias of all other types taken together. The reason for this is not far to seek, because, in large areas of suppurating surface, a tremendous amount of toxin and bacterial ferment, as well as the bacterial bodies themselves, is created and given admission to the circulation. These poisons at first increase the leukocyte count. When long continued, they tend to produce leukopenia and secondary anemia, and we do not know whether this is due to interference with the creation of new blood cells or to the wasting of existing blood cells. Research is now being conducted to determine this question, if possible, and I know of no greater service that the periodontist can render to patients, no greater assistance that he can give the internist than by overcoming such infections, thereby rapidly changing a leukopenia and a secondary anemia with low hemoglobin index to normal blood conditions. The following cases are illustrative:

*Read before the American Academy of Periodontology, Minneapolis, Minn., Aug. 17, 1928.

REPORT OF CASES

CASE 1.—Mrs. D., aged 47, and moderately well, complained only of being very tired, and tiring much more easily than she normally should. The temperature was normal as was the pulse rate. Hemoglobin was 65; red cell count, 3,000,000, white cell count, 4,600. The general condition and the appetite were fair. Elimination by skin, bowels and kidneys was normal. The principal and most noticeable symptom was, as before indicated, weariness. All the teeth were present, and there was comparatively little decay. The mucous membrane surrounding the teeth was purplish.

The depth of pocket was from one-eighth to one-quarter inch. The single-rooted teeth were movable in their sockets; the multi-rooted teeth, for the most part, fairly rigid in their attachments. The patient was put under treatment, June 1, 1926. The root surfaces of two upper molars were on that day perfectly cleaned of deposits. The patient had demonstrated to her, by bacterial stain, the bacterial masses, which were great, between and on the sides of the teeth, gingivally from the greatest convexity over the whole denture. She was at that time taught the use of the toothbrush, bending the bristles on the teeth toward the gum until they rested on the gum, then thrusting them in between the teeth for a frictional movement which swept the sides of the teeth by the bristles and the edges of the gum as well. In addition to this, she was taught the use of cotton wrapped toothpicks to wipe the interdental spaces as nearly free from bacteria as possible. Treatments were administered every fifth day, resulting in a gradual rise in hemoglobin, a steady increase in the number of erythrocytes and a corresponding increase in the leukocytes. November 1, the hemoglobin stood at 87; erythrocyte count, 4,500,000; leukocyte, 7,800. Best of all, the weary feeling gave place to a normal vigor, which as far as the patient's own conception of her condition is concerned was most gratifying.

The following case is also one of interest in that the history impresses one with the fact that, from a clinical standpoint, toxins and ferments absorbed from the alveolar neighborhood may play a deadly part in reducing the body's vitality.

CASE 2.—Miss R, aged 38, commenced treatment Sept. 4, 1918. The hemoglobin on that date was 65 per cent; the red cells numbered 3,000,000; white cells, 4,500, with polymorphonuclears 81 per cent and lymphocytes 14 per cent. This division of the white cells strongly suggested the presence of chronic infection. The small leukocyte body and high percentage of polymorphonuclears indicated this condition. September 16, the hemoglobin had risen to 75 per cent, the red cell count to 3,700,000, and the white cell to 7,500, while the polymorphonuclears had dropped to 78 per cent and the lymphocytes increased to 17 per cent. This seemed to suggest a less degree of toxin absorption. December 4, the hemoglobin had risen to 85 per cent, the red cell count to 4,200,000 and the white cell to 8,500. Associated with this change in the blood picture was an increased energy which was gratifying to both patient and dentist. Here, was a lessened toxin and bacterial absorption associated with a constantly rising energy, an increase in hemoglobin, red cells and white cells running parallel. Could there be anything more suggestive of the value of the treatment afforded in this case? No tonics, no change in diet from that on which the patient had subsisted for previous years was suggested. There was only one suggestion made, and that was that water consumption be increased to 8 ounces for every 10 pounds of body weight.

CASE 3.—A woman, aged 55, had lost half of her teeth from pyorrhea, and at the time she came in for treatment, most of the remaining teeth were candidates for extraction. On examination, April 17, hemoglobin was 75; red cell count, 3,200,000, white cell count, 7,900. After extraction of some loose teeth and the treatment of those which were deemed savable, May 7, hemoglobin was found to be 82 per cent with a 4,200,000 red cell count. June 21, the hemoglobin had risen to 84 per cent and the red cell count had remained stationary. October 17, the hemoglobin was still 84 per cent, but the red cell count had risen to 4,500,000. Coincidently with this change in the blood picture, the patient gained in energy and a condition of torticolis or wry neck with which she had been troubled for some months completely disappeared. Evidently, the wry neck was caused by a metastasis via the venous and lympathic circulation from the deep lesions in the jaws to the muscles of the neck, and cutting off the continual emigration of bacteria and their products into the tissues of the neck enabled the tissue cells and leukocyte body to gain the upper hand of this focus of infection, permitting rapid repair.

"ISMS" FOR THE EXODONTIST, GARNERED FROM THE PRESS, THE MEETINGS AND THAT OLD FRIEND, "EXPERIENCE"

By ALBERT D. DAVIS, B.Sc., D.D.S., M.D., San Francisco, Calif.

SIMPLE EXTRACTIONS

1. Anatomic consideration of both tooth and alveolar process are necessary if "simple" extractions are to remain simple extractions.

2. A sharp cutting chisel is quicker, safer and cleaner than a bur for cutting tooth or process.

3. Use either elevator or forceps but *know what* each *will do* when they are used.

4. Brute strength always fails when matched against skill.

5. Proper applications of force, with the greatest respect for normal tissues, will result in a cleaner, quicker operation and a shorter convalescence with healing by first intention.

6. A few moments' careful study *before* operation may mean the saving of time during operation.

7. Postoperative care is just as important as operative practice.

8. Guard against débris falling into the open wound (fragments of filling material, tartar, instrument points, etc.).

9. After extraction is complete, have the patient bite down on a piece of sterile gauze inserted over the wound for one hour. This preserves the clot, insures better healing, obviates postoperative pain and hemorrhage.

10. Caution the patient against sucking on the wound, expectoration and rinsing the mouth for at least twenty-four hours.

IMPACTIONS AND COMPLICATED EXTRACTIONS

1. Obtain an "open-field" whenever possible.

2. Cut away enough bone or tooth to make the extraction a possibility.

3. Conservatism is the keynote to success in exodontia. The jaw belongs to the patient—the tooth *only* to you. Do not destroy or take away what is not yours.

4. A bur tears, burns and leaves débris. A sharp chisel cuts smoothly, cleanly and quickly.

5. Follow the golden rule when operating and your patient will get a better service.

6. Preserve the "housing" of the bone. A clean-cut incision, careful stripping with a suitable periosteal elevator and well placed, suturing will prevent a great deal of postoperative pain.

7. You replace the turf in a golf game. Have the same respect for the oral tissues.

8. Most of the sutures and most of the needles used in the practice of exodontia are too large. Nature is kind; but cooperate with her.

9. Careful manipulation will triumph over force every time.

10. Insist on good roentgen-ray films beforehand. Check up on the amount of tissue destruction by a few postoperative films as well. It will teach you care.

11. A 2-quart irrigation of warm anti-

septic solution is soothing and cleansing. A few squirts with a spray bottle is just a little better than nothing.

12. A dry socket is a tragedy which can generally be traced to some fault in technic. Avoid its repetition.

13. Gas-oxygen anesthesia belongs to the hospital service.

14. Removal of impacted teeth for aged individuals, in the majority of cases, should not be done.

15. Consultation oftentimes is of benefit, not only to the patient but to yourself as well.

THE MAXILLARY SINUS

1. Antral disease of dental origin belongs to the field of oral surgery. Unless your training is such as to enable you to handle an antrum case correctly, the patient should be placed in the hands of a trained man.

2. The canine fossa is the anatomic site for opening the antrum, but variations occur.

3. Avoiding the necessity for an antrum operation, by skilful technic in exodontia, is a greater service to the patient than *any* antrum operation.

4. Any operative interference with the mucosa on the antral side of the nasal wall belongs to the field of nasal surgery.

5. A plastic operation, properly designed to suit the case, is necessary in most instances to close an oro-antral sinus.

6. Partial alveolectomies allowing an "open field" operation will eliminate many antrum operations, especially in those cases in which the apices of diseased teeth encroach on the antral floor.

7. Never irrigate the antrum through the mouth longer than is necessary to get a clean field.

8. Avoid packing the antrum. If necessary to pack, remove the packing within from twenty-four to forty-eight hours.

MISCELLANEOUS

1. Curved incisions are the rule rather than the exception for surgery about the teeth.

2. Anatomic consideration of gums and gingivae will point out why straight-line incisions are rarely used.

3. Gardner recommends a pack for dry sockets consisting of a paste made of anhydrous wool fat (lanolin) and powdered acetylsalicylic acid.

4. Curet enough to eliminate the disease, but do not be overzealous. The curet can be abused as well as used.

5. Ice is always indicated extra-orally after exodontia.

6. Patients have less reaction to procain-epinephrin if placed in a prone or a semiprone position while blocking is being done.

7. Always have restoratives at hand and *know how* and *when* to use them.

8. Take plenty of time with the anesthetic. Tissue trauma is unnecessary. Allow from thirty to forty-five seconds to intervene between the deposition of the first few drops and the balance of the blocking.

9. Horsehair is the material of choice for all mouth surgery.

10. Keep your instruments clean and *sharp*. A dull elevator is a cruel instrument, and cuts down your operative time as well.

11. Believe in yourself, but *if in doubt,* do not hesitate to call in consulation one who has had a broader experience or better training.

12. Burnishing the cellular bone after any process trimming prevents hemorrhage and edema.

13. A quiet, assured manner, as well as a softly modulated voice, is a professional asset, and both do much to allay fear.

209 Post Street.

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C. N. JOHNSON, Editor

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Editorials

WHY NOT HELP?

A recent conversation with the dean of one of our dental schools revealed an altruistic attitude of thought that it would be well for every member of the profession to emulate. The subject under discussion was the establishment of libraries in dental schools, and there was at once recognized the chief difficulty with most schools, namely, a lack of funds. Of course, there are some schools the faculties of which show little disposition or aptitude for building a library, but for the most part the greatest obstacle is a meager treasury.

In view of this, it is encouraging to note that there is a disposition on the part of the Carnegie Foundation to contribute certain sums for library purposes to various dental schools in this country and Canada, and this has led some of our deans who heretofore have not been particularly interested in the subject to study the problem of a dental library and familiarize themselves with the

proper procedure for organizing and conducting such an enterprise. This is an indication of the fact that our dental teachers are not indifferent to the needs of their various institutions, but that the chief handicap in the past has been, as just intimated, a lack of money.

In discussing this question, Lewis E. Ford, dean of the School of Dentistry of the University of Southern California, gave expression to the following sentiments:

"Why not have the colleges help each other in building libraries? There could be exchanges between colleges in case of duplication of books or magazines. And not only this: why should not the schools who have libraries make donations to those who at present have none? Let the so-called big fellows help the so-called little fellows and encourage them to organize libraries. And in this connection there are many other ways aside from libraries whereby the strong schools might help the weaker ones. No one can know the heartaches that have been caused by the fact that certain schools have been compelled to suspend operations on account of their inability to meet the required standards. Men have put the best energy of their lives into college work, only to find that their efforts practically count for nothing owing to conditions over which they had no control. It might have been their location or it might have been circumstances peculiar to their environment that forced them out; but in any event, in the majority of instances, it was no fault of the men most interested in the schools. In how many of these cases might it not have been possible to stem the tide of disaster and turn the current into easier channels if the stronger and more fortunate schools had rallied around them and helped to pilot them over the breakers?"

This pronouncement by Dean Ford is worthy of the deepest consideration. He is at the head of a school that has prospered, and therefore he has no personal ax to grind. And he is big hearted enough to visualize the good that could be done by cooperation.

What we need in dentistry more than anything else is a spirit of helpfulness one for the other. We need to learn the sublime lesson that the greatest growth and the greatest happiness come

not from helping oneself but from helping others. The more we give, the more we have; and the more we keep, the less is ours. We need more magnanimity and less selfishness, more generosity and less avarice. We must grow in grace—the grace that tunes our hearts to the needs of our suffering fellowman and makes us reach out the hand to succor and to save instead of to oppress or exploit. The spirit of helpfulness would go a long way toward regenerating the world; and, in this little world of ours called dentistry, this spirit would soon bring a smile to many of those who have been struggling against adverse fates in the form of blasted hopes and disappointed dreams.

It would be a queer individual who would not throw a rope to a sinking man. Let us lend aid to institutions as well as to men, because institutions are made up of men, and most of them have a soul.

HAVING A GOOD TIME

I have had a good time today. First, I said good morning to a blind man in such a way that he smiled; and he even waved his hand at me—something I never saw a blind man do before. Did you ever sit quietly down and try to imagine what it would be to be blind? I have, and the reflection fills me with gratitude for my blessings—above all for the blessing of sight. How seldom do we pause long enough in the petty annoyances of life to count our blessings—it would be well for us if we did it oftener.

Next, I was privileged to pick up a curly-haired little boy who had fallen and hurt himself—hurt his pride more than his body—and I soon got a smile from him by saying: "These sidewalks are terribly rough, aren't they? I don't see how any one manages to walk on them." To place the blame on the sidewalks was balm to his soul, and he was instantly happy.

Then, I saw a crippled girl standing at a street crossing trying to get to the other side, but afraid to venture lest the lights should suddenly change and catch her in the middle of the street. I am rather diffident about approaching strange girls on the street, but

something had to be done, so I said to her in the most matter-of-fact manner: "Wonder if you hadn't better cross over with me when I go? This traffic is pretty bad." The look that girl gave me sanctified my soul, and it will remain with me longer than the worst rebuff that I have ever had. Why is it that so many crippled people have such a happy smile? I don't know; but it makes me ashamed of myself. I complain at such trivial things, but I hope that I shall not after this.

Next, I stopped a man from beating his horse, and this is the way I did it: In the mood that the man was in, to have remonstrated with him would have increased his passion, and he would have beaten the horse harder and probably turned on me. I looked at the horse as if I were disgusted with him, when as a matter of fact I pitied him beyond measure. "Horses can be the most provoking animals on earth," I said, as if sympathizing with the man. I said it in a kindly tone, and the man became suddenly interested—it was so different from what he expected. In the pause, I continued: "What has he been doing now? Seems like a fine looking horse too." There was never a man who was not inwardly flattered by being told that he had a fine horse. I wasn't much interested in the man's recital of his grievances against the horse—I had gained my point—he wasn't beating the horse any more. Together we soon worked out a plan to control the horse—I *do* know something about horses. The horse was not struck another blow after I made the first remark, and all parties felt better. But I hope that man will never know my opinion of him when I saw him abusing his horse.

Later in the day, I went to call on an invalid friend who was unable to go out and who craved company. Ordinarily, there would have been only a meager and customary virtue in doing this, and little ground for self commendation, but it chanced that I went on this occasion at a great sacrifice and the invalid knew this. What the invalid said is not here recorded—it is not essential to the story—but the day was brighter for both of us. Surely I was having a good time.

A man had written me a very saucy and contemptible letter. He had laid it on with all due emphasis, and repeated an untruth

about me several times. The letter was so unjust that I had to lay it down after reading it and do some vigorous thinking. I came near to suffering defeat in the matter—I came near to indulging in resentment and writing him back in the same vein. This would have been a sacrifice of principle and would have placed me too nearly in the same category with him. It is seldom safe to answer a letter like that the day it is received—it is usually best to lay it away till the hurt has somewhat subsided. But today I managed to get hold of myself and I wrote him the nicest letter I could pen —yes, I even wrote it with a pen—and explained to him wherein I felt he had been misinformed, and I vindicated myself without permitting any venom to intrude. A good rule to follow in writing letters is always to contrive to end every letter in such a way as to make the recipient your friend. Whether or not you succeed in doing this, you have at least disciplined yourself in making the attempt, and this kind of discipline is good for all of us.

But the best fun I had today was this: Some one was repeating a derogatory thing about a man who had done me a grievous injury. I happened to know that the thing that was being told was not true, and I promptly said so. I defended the subject of the criticism in such a manner that there was no mistaking what I meant. The critic looked at me in amazement. "I thought you and this man were not friends," he remarked. "We are not," I said, "we are anything else." "Why are you defending him then?" asked the other. "I am not defending him in a general way, because he has done such disreputable things, and I do not justify that in any man, but in this instance you were relaying an untruth about him, and there is nothing to be gained by spreading falsehoods. I sometimes think there is very little to be gained by peddling derogatory remarks about any one, even if they are true." The man looked at me queerly for a moment, as if he were studying a new species of freak, but he said not another word against my enemy.

That was happiness enough for one day, and let me ask the question: What would have happened to me that day if I had ignored the blind man or passed the curly-headed boy without picking him up; if I had let the crippled girl shift for herself

across the street; if I had permitted the man to continue beating his horse; if I had missed going to see my sick friend; if I had answered the saucy letter in the same spirit; or if I had sat silent while a falsehood was being told of another? What would have happened to the others is a conjecture, but there is no question as to what would have happened to me. I would have sunk so low in my own esteem that it would have brought me much unhappiness. As it was, I was having a thoroughly good time.

THE TERM ANTISEPTIC AND ORAL PREPARATIONS

In current bacteriologic textbooks, a germicide is defined as a substance or agent that destroys micro-organisms so that they will not grow when placed in appropriate culture mediums; an antiseptic is defined as a substance that prevents the growth of micro-organisms as long as certain conditions are maintained, but does not necessarily destroy their vitality. While these definitions of "germicide" and "antiseptic" have been generally recognized, the terms have been used carelessly by many dental and medical writers—not to mention the slipshod and sometimes unwarranted use of these terms by those engaged in the business of selling mouth washes, tooth pastes and the like to the profession and the public. While not referring to dentifrices, the writer of a well-known textbook on bacteriology, for example, has expressed himself thus: "Most proprietary disinfectants are disproportionately expensive, and owing to the lack of precise information as to their composition and strength, relatively untrustworthy."[1]

While dentists and physicians are aware that a germicide may produce effects on an infected area in a brief period which can be produced by an antiseptic only by prolonged contact, to the general public these terms are synonymous. In view of this fact, the Bureau of Chemistry of the U. S. Department of Agriculture, the agency of the government charged with the enforcement of the Food and Drugs Act, has stated that the term "antiseptic" when used on a

1. Jordan, E. O. A.: Text Book of General Bacteriology, Philadelphia, 1928, page 90.

label of a medical or dental product is objectionable unless the preparation when used as directed will actually destroy micro-organisms. Reasoning from the action of the U. S. Bureau of Chemistry, *The Journal of the American Medical Association,* a little over two years ago, stated, "Since an antiseptic remedy means to the public one that acts against sepsis—that is, prevents the condition as much as possible—the bureau holds that the purchaser of such a preparation should therefore be given full benefit of the meaning of the term. If this is not done, a false sense of security is produced and possibly valuable time wasted in using a product that does not have positive germicidal effect."

This is no more applicable than with such products as mouth washes, gargles, tooth pastes and tooth powders, which are widely advertised to the public as preventives or curative agents for many mouth conditions, which are supposedly due to micro-organisms. In this connection, the work done by Leonard and his associates at Johns Hopkins University[2] is not without interest. These workers have shown that "of the forty-one brands of tooth paste purchased on the open market and examined for antiseptic action (the term antiseptic action is used in accordance with the ruling of the U. S. Bureau of Chemistry) . . . not a single preparation was found to be capable of destroying *Staphylococcus aureus* even after five minutes exposure." Of these forty-one brands, eight accounted for about 90 per cent of the entire tooth paste consumption in the country.

Viewed from a standpoint of the general user, the situation simmers down to the fact that these preparations are necessarily in only brief contact at the time of administration and are subject to immediate dilution *in situ*. If, therefore, the effect produced involves only inhibition, their action on micro-organisms must be inconsequential. The corollary would also follow that tooth pastes and the like cannot be considered as means of mouth medication, especially when the suspected cause points to the presence of micro-organisms. From the standpoint of preventive dentistry, denti-

2. Feirer, W. A., and Leonard, Veader: Antisepsis in Hygiene of the Teeth and Gums. J. A. D. A., 14:1049 (June) 1927.

frices are useful as a means of keeping the mouth clean—to use the word in a very general sense.

HAZARDS FROM ROENTGEN-RAY FILMS

A little over a month ago, the whole country was shocked by news of the explosion and fire from roentgen-ray films in the Cleveland Clinic and the fatalities following it. This accident has awakened a new interest in the handling and storage of films. While conditions in dental offices are not altogether comparable to those found in a large clinic, there are certain lessons to be gained from that disaster. As THE JOURNAL remarked in a recent issue,[1] "One of the most significant things connected with our profession is the fact that in almost every dental office there are numerous old roentgen-ray films stored away and while in the nature of things the circumstances which surround roentgenograms in private offices differ from those in a large clinic, the fact remains that great care should be taken in handling such material and a recognition made of the fact that they are dangerous."

A recent issue of *The Journal of the American Medical Association*[2] carries a lucid explanation of the probable cause and an explanation of the chemistry involved in the burning of the films. The toxic effects of the burning films have been ascribed to nitric oxid, which in air yields the heavy brown gas, nitrogen tetroxid, familiar to all students of first year chemistry; and to carbon monoxid and possibly other irritating substances. But the chief culprit, so to speak, was the dangerous nitrogen tetroxid from the nitrocellulose of the inflammable type of film.

The same issue (p. 1763) also carries an abstract of an article "Minimizing the Fire Hazards of X-Ray Films,"[3] which gives a number of general rules and precautions to be observed in the

1. The Cleveland Clinic Disaster, Miscellany, J. A. D. A., 16: 1143 (June) 1929.

2. The Hazard of Toxic Gases from Combusion of Roentgen-Ray Films, Editorial, J. A. M. A., 1929:92 (May 25) 1764.

3. Hobbs, R. D.: Mod. Hosp., 31:79 (Nov.) 1928.

handling and storage of roentgen-ray films, from which the following is taken:

1. A metal can having a self-closing spring hinged cover and approved by the Underwriters' Laboratories should be provided for all waste negatives and film scrap, and at no time should these be permitted to accumulate and lie around on tables, benches or floor.

2. Stocks of unexposed films should be kept at a minimum. Only a limited supply should be kept on hand at any one time.

3. In rooms where films are filed or handled there should be no flames or any other than standard electrical fixtures. The use of portable lights on extension cords should be prohibited. All open lamp bulbs should be protected from breakage by suitable guards. An approved hand fire extinguisher should be in each room where films are handled. Doors of dark rooms and of other rooms should be arranged so as to make egress easy.

4. Film negatives should be filed as soon as possible in heavy manila envelops, either singly or by case. These should be conveniently arranged so that from time to time useless negatives may be weeded out.

5. Film illuminators shall be so designed that the diffusing glass is not hot to the touch and there shall be no unnecessary display of film negatives in lighted illuminators. Negatives set up for viewing shall be confined to those actually being inspected.

6. Smoking shall be prohibited in rooms where films are stored, in developing rooms and in similar workrooms. "No Smoking" signs shall be posted in prominent places.

7. No films shall be stored within 2 feet of steam pipes, radiators, chimneys or other sources of heat.

BUREAU OF CHEMISTRY

EPICOL

"Dental Treatment by Correspondence"

EPICOL (The Epicol Products Company, Minneapolis, Minn.) is a "cleansing, healing, saline solution" sold directly to the public.

Statements appearing on the carton and on the label of the bottle more or less directly recommend Epicol for use in many diseases of the teeth and oral cavity. One of the methods of the manufacturers of secret remedies is to play on the fear of the credulous or the ignorant. Nowhere is this fear more overplayed than in so-called acid mouth and pyorrhea. The vendors state that Epicol

Makes the gums firm and healthy, prevents receding. Soft, spongy, bleeding gums are the first indication of pyorrhea.

Reading further, one learns that

Poison from diseased gums and infected tonsils, absorbed by the system causes indigestion, stomach ulcers, stomach catarrh, nervousness.

Thus the inference appears clear that one should use Epicol and avoid indigestion, stomach ulcers, stomach catarrh, nervousness.

The following claims for Epicol appear on the label:

Pyorrhea
Acid Mouth
Spongy Bleeding Gums
Sore Throat
Tonsilitis
Nasal Catarrh
Bad Breath
After extractions.

Further claims made are:

Cleanses, purifies and disinfects the oral cavity without interfering with normal physiological activities.

Prevents the ready formation of tartar.

It has been repeatedly pointed out in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION, as well as elsewhere, that the reaction of the saliva, as normally found, is slightly acid—but inconsistency between demonstrable fact and claim hardly troubles the nostrum exploiter. What a preparation lacks in scientific merit is made up by unfounded claims in the trade on fear. Even this is overshadowed when compared with a claim that a mouth wash, without the attention of a dentist, will cure or prevent pyorrhea. It has already been pointed out in these columns that any condition approaching pyorrhea or gingivitis in any stage requires the expert attention of the dentist. One of the outstanding dangers to the public in the indiscriminate use of such preparations lies in the sense of false security on the part of the credulous user; the need for scientific care being thus overlooked. As an example of the regard in which the Epicol people hold their product, there is reproduced a letter from the Epicol Company giving somewhat detailed directions for the use of Epicol in pyorrhea. To comment on mail order dentistry of this type would be like refining pure gold.

It is but fair to state that the vendors of Epicol, while recommending their

EPICOL PRODUCTS COMPANY
Manufacturers
305 SOUTH FIFTH STREET
MINNEAPOLIS, MINN.
May 17, 1929

[redacted]
Chicago, Ill.

Dear Miss [redacted]

In answer to yours of the 14th in which you ask us to make suggestion as to the use of Epicol for Pyorrhea, our suggestion would be as follows:

Warm the Epicol as hot as can be tolerated in the mouth and hold it in the mouth for about a minute, working it around well so that it comes in contact with every portion of the gums, thus giving it a chance to get down around the edges of the gums and teeth. Then massage the gums thoroughly with the ball of the thumb, working the thumb movement from the bottom of the gums towards the teeth, using as much pressure as you can. Do this for several minutes, then again use the warm Epicol as suggested above. You should do this night and morning.

In case the pyorrhea is of long standing, it may be well to consult a Dentist and have him open up the pus pockets and thoroughly drain them, but for incipient Pyorrhea we think the above suggestions will prove satisfactory, at least many people have told us so. Do not, however, expect to treat the gums only a few times is going to produce results. Pyorrhea usually develops slowly and it takes considerable time to get the gums in a normal, healthy condition again, you will, however, after a few days notice that the gums are not so tender and will feel firmer to the touch.

We will be pleased to hear from you from time to time, telling us how you are getting along, not of course for publication, but we will be very glad to know what success you have obtained from the use of Epicol.

Very sincerely yours,
EPICOL PRODUCTS COMPANY

DEL:MW By D. Laing

Fig. 1.—Dental treatment by mail—without examination.

product as a mouth wash, do not, as far as we have been able to discover, use the word "halitosis." Due credit should be given for such restraint.

In order that the profession and the public might learn something of this "cure" for pyorrhea, acid mouth, etc., the product was referred to the A. D. A. Bureau of Chemistry for examination. The Chemist's report follows.

A. D. A. CHEMIST'S REPORT

"One (1) original package of Epicol (Epicol Products Company, Minneapolis, Minn.) was purchased on the open market for examination.

"The following appeared on the label of the bottle:

Acid Mouth. Acid Mouth means acid Saliva. Use Epicol frequently; best results obtained if used full strength.

Influenza, Grippe—a clear mouth, nose and throat is the best preventative. Gargle or spray with Epicol three or four times daily.

Pyorrhea. Use Epicol daily, full strength, after meals. Hold in mouth for a few minutes, working it thoroughly between and around the teeth.

Alcohol 5%.

"The bottle contained 595 c.c. (approximately 20 fluid ounces) of a clear, red liquid, possessing an odor of oil of cloves and cinnamon, and having a saline taste. A slight white sediment was on the floor of the bottle. The liquid was alkaline to litmus. It had a specific gravity of 1.001 at 22 C.

"Qualitative analysis indicated the presence of sodium, chlorid, carbonate, borate, salicylate (probably from hydrolysis of oil of wintergreen) and alcohol. Sulphates, phosphates and heavy metals were not found.

"Quantitative determinations yielded the following:

Total Solids 100 C	1.22 per cent
Ash	0.97 per cent
Sulphated ash	1.20 per cent
Sodium (Na^+)	0.38 per cent
Chlorid (Cl^-)	0.30 per cent
Borax ($Na_2B_4O_7.10H_2O$) calculated to:	0.54 per cent

Pyorrhea—Use EPICOL daily, full strength, after meals. Hold in mouth or a few minutes, working it thoroughly between and around the teeth.
Bad Breath—Use EPICOL frequently, full strength. Work it around the gums and between the teeth. Brushing the teeth with EPICOL helps sweeten the breath.
Nasal Catarrh—Dilute EPICOL one-third to one-half with warm water and spray nose regularly night and morning.
Spongy, Bleeding Gums—Use EPICOL full strength, three times daily.
Contents 20 fl. ozs. 5 per cent Alcohol
Cleansing Healing
Saline Solution
EPICOL
MINN. A-414
Pyorrhea — Acid Mouth
Spongy Bleeding Gums
Sore Throat — Tonsilitis
Nasal Catarrh
Bad Breath
After Extractions
EPICOL PRODUCTS COMPANY
MINNEAPOLIS
Sore Throat, Tonsilitis—Gargle or spray throat with EPICOL, full strength, every fifteen minutes for first hour; then every half hour. If too strong, dilute one-third with warm water. No harm if some is swallowed as EPICOL is non-poisonous
Acid Mouth — Acid Mouth means acid saliva. Use EPICOL frequently; best results obtained if used full strength
Influenza, Grippe—A clean mouth, nose and throat is the best preventative. Gargle or spray with EPICOL three or four times daily.
After Extractions—Use EPICOL full strength, or as instructed by by your Dentist

Fig. 2.—The self-diagnosis and treatment system of Epicol.

Carbon dioxid	0.21 per cent
Ether extract (salicylic acid)	0.11 per cent

"From the analytic results, it may be calculated that Epicol contains as essential ingredients:

Sodium chlorid	0.5 per cent
Sodium bicarbonate	0.4 per cent
Borax	0.6 per cent

"From the foregoing, a solution having essentially the same composition as Epicol, as found in the trade bottle, may be made by dissolving sodium chlorid (salt), 3.0 gm. (approximately one-tenth ounce); sodium bicarbonate (baking soda), 2.4 gm. (approximately one-thirteenth ounce); borax, 3.6 gm. (approximately one-ninth ounce); adding 30 c.c. of alcohol (U.S.P.), flavoring and coloring matter, and diluting to 600 c.c. (20 fluid ounces)."

In the light of the Chemist's findings, the unfounded and exaggerated claims made for Epicol become apparent. The indiscriminate use of common agents, masquerading under secret names, while in themselves harmless, leads to the ever-present danger from the sense of false security that the use of such preparations inherently carries. The public should be made to appreciate that measures and means for relief from pyorrhea and other pathologic conditions of the oral cavity should be in the hands of those most qualified to treat such conditions. Self-medication leads to but one end—an aggravation of a condition, with possible loss of tooth function.

It is not without interest to note that the estimated cost of a volume of Epicol equivalent to that in the trade bottle is less than 3 cents,—exclusive of overhead. Thus, the profit must be tremendous.

MU-COL

Mu-Col (The Mu-Col Company, Inc., Buffalo, New York) is a secret preparation advertised to the profession and to the public.

At one time, Mu-Col was recommended by The Mu-Col Company, directly or indirectly for:

Leucorrhea, Vaginitis, Catarrhal Gastritis, Cystitis, Colitis, Internal Hemorrhoids, Nasal, Post-Nasal and Pharyngeal Catarrh, Pruritis, Urticarias, Eruptic Fevers, Pneumonias, Cancer, Genito-urinary conditions.

This is but a partial list of the conditions for which Mu-Col was recommended.

USE MU-COL
Dentists know that a policy of "out of sight, out of mind" will not do for their patients, so they preach the necessity and many advantages of oral hygiene, constantly.
Thousands of dentists have adopted MU-COL in their practice. They know it is especially beneficial when used as a mouth wash following extractions,—first in hot solutions hourly and then cold, less frequently. They have seen how it reduces inflammation and irritation, stops pus formations, and quickly tones up the whole oral cavity. They tell their patients to use it continually between calls, as a safeguard against major troubles.
Let us send free testing sample to-day
THE MU-COL CO., CH-6-9
TUPPER AND EDWIN PLACE
BUFFALO, N. Y
Please send your testing samples
D.D.S
Enclose card or letterhead

Fig. 3.—Advertisement from a recent issue of a dental journal. How would the dentist be impressed if the advertisement read "Use table salt and borax"?

The present claims for the product assume a more moderate tone. It is now recommended for:

Mouth wash, After Extraction of Teeth, For Nasal Application, Throat Gargle, After Smoking, Tongue Burns, etc., Tired, Tender, Troublesome Feet, Prickly Heat, Sunburn, Itching Piles, Vaginal Douche.

In order that the dental profession might be advised of the composition of

this product, which was recommended for all the ailments listed, the Chemist of the American Dental Association recently addressed a communication to the manufacturers requesting the qualitative and quantitative composition of the product. The following is taken in part from the reply of The Mu-Col Company:

> The composition of Mu-Col is secret, and during the 26 years that it has been marketed through the Dental and Medical profession, it has not been our policy to quote its formula and we do not anticipate any change of policy within the near future.

Thus, Mu-Col is admittedly a secret remedy. The dentist or physician who wishes to know the composition of the product that he is asked to use is told, in more or less polite language, "That's none of your business." This policy is contrary to the development of a scientific and rational materia dentica.

Subsequent investigation showed that, in spite of the assertion of The Mu-Col Company, the essential composition of Mu-Col has been available for about fifteen years, but apparently not from the willingness of the vendors of Mu-Col. Some years ago, the A. M. A. Chemical Laboratory issued a report on the product. Excerpts from that report follow:

> The specimen examined was a white powder, and from the odor, thymol, eucalyptol, camphor and oil of wintergreen could be recognized. Qualitatively sodium, chloride and borate were found.
>
> Zinc, benzoate, phenolsulphonate and sulphate could not be found. The solution was alkaline to litmus. Gravimetric determination of chloride as silver chloride and titration of borax by Thompson's method indicated sodium chloride (NaCl) 47.2 per cent, sodium borate ($Na_2B_4O_7.10H_2O$) 50.1 per cent. [This was confirmed by the A. D. A. Bureau of Chemistry on a sample of recent purchase.]
>
> It thus appears that Mu-Col is a mixture of ordinary salt and borax in equal parts with the addition of a small amount of aromatic substances.

To which *The Journal of the American Medical Association* added:

> Mu-Col will do just what a solution of salt and borax will do—no more, no less.

It might be of interest to note that a two (2) ounce package of Mu-Col sells for 35 cents—the cost of the contents may be estimated from the above to cost less than one cent—exclusive of overhead.

BUREAU OF DENTAL HEALTH EDUCATION

THE DENTIST AND THE PRESCHOOL CHILD*

By SUSAN M. COFFIN, M.D., Boston, Mass.

ALONG with parents, doctors and nurses, dentists have a vast opportunity to increase the health of young children. To do this intelligently, how much of a pediatrician must a dentist be? He is at the start a specialist among specialists. He has, in my opinion, been taught to confine his attention too closely to the mouth of the person whom he is treating and has not been taught sufficiently to work with his patient as a whole. Teeth are a useful index of nutrition; so is weight. But we have learned well the fallacy of judging the child by weight alone. You have many children come to you who need a thorough physical examination. You can see at a glance that they are pale, thin, tired; their nutrition is below par; they have more than bad teeth, they need more than dental care—they need medical care also. You have the opportunity to point out to the parents this need, to show them that the dental condition is but another index of the general condition. No matter how fine appearing a child is, if he shows defective teeth he needs medical examination, and a study should be made of his diet and habits. Make sure that the parents understand this need of regular and thorough physical examination. You are daily astonished, as I am, that there are so many—simply hordes—of well meaning but tremendously ignorant parents. They did not have enough training for parenthood, just as you and I did not have enough training for preventive work in our jobs.

Do you know a well child? Many of us don't in the medical profession so I feel free to ask such a question. Many of us, both dentists and physicians, call almost any child a "well" child. We examined recently in our Demonstration Well Child Conferences 851 "well" children who were "all ready" to enter school according to their mothers or the neighbors. Of these children, 86 per cent had definite physical defects needing medical attention. Incidentally, 51 per cent had dental defects, and these were all children under 6 years of age. The youngest child showing dental caries was 18 months old.

We are after one thing in all our preventive work with children: to cut down child morbidity and child mortality. Eight thousand of our entering school children repeated first grade last year, about one tenth of the first grade population. They all entered school as "well" children, but were they? You and I know that they were not. If they had been, that figure would not have been anything

*From the Massachusetts State Department of Health.

*Read before the Section on Children's Dentistry at the Massachusetts State Dental Society, Boston, Mass., May 7, 1929.

like so large. In Massachusetts 136 children under 4 years died of diphtheria alone in 1927. Was that necessary? We know now that it was not. Has your little patient had treatment for diphtheria prevention (toxin antitoxin)? Have his parents ever heard of it? There is plenty of good printed matter on the subject for free distribution. If you are too rushed to talk about it, send a leaflet with your bill. Two cents carries both. In a word, do you do your share of preventive teaching? Your opportunity is great, and opportunity means responsibility, as our old copybooks rightly told us!

In the state department of public health, we have one among many great ambitions: to have every parent in Massachusetts realize the necessity for prenatal care, and to see the day when no woman in this state can say that it is impossible for her to have adequate dental and medical care during pregnancy. More and more prospective mothers go to their dentists fairly early in pregnancy. Many will tell you of their condition. Most know nothing of the importance of diet to themselves and their babies during pregnancy and lactation. You know it better than many doctors because you have studied in detail the effect of food intake on nutrition and the development of the teeth during fetal life and early infancy. Again, your patient needs help other than just dental. Urge prenatal care with the family physician and tell her of the importance of her own diet and of breast feeding if her baby is to have normal development, including normal teeth.

One intelligent country mother who was much impressed with her dentist's advice along this line said, "If all the babies get good teeth, it won't be so good for him either." I took considerable pleasure in telling her that the best physicians and dentists all over the world today are working for the time when there will be very few bad teeth and, we hope, very few sick mothers and children for us to treat, among intelligent people.

A mother brought us a girl of 5 years and told us that she was "real worried" about her. She said, "She hasn't eaten a single mouthful for three days, just drinks milk. I can't get her to take anything else." "Have you looked at her mouth and throat and taken her temperature?" she was asked. No, she hadn't thought of that; Lizzie hadn't felt sick enough. Lizzie had the worst looking jaws that I have ever seen in a child under 6 years. Her teeth were nearly all decayed to the gums; and pus oozed from half a dozen places. I showed the mother the child's mouth, saying nothing, and she looked at me in amazement. "I guess she *couldn't* do much eating," said the mother. That mother had never thought to look in the child's mouth and she was not an extremely ignorant or careless mother either. She had been "halfway through high school," and she kept her home and children rather above the average in matters of cleanliness and order. There are thousands like her who were never taught the simplest essentials of child care.

We have been asking every mother to look at every little child's mouth and throat (using a spoon handle) once a week, and we are beginning now to have mothers tell us they do it regularly.

We have had mothers who acted as though they thought it was not quite right for them to know anything about teeth and tonsils: that was holy ground belonging to doctors and dentists only! So, we ask your aid in teaching parents to make regular mouth and throat inspection. When the throat "looks queer" is the time to consult the family doctor. When

the teeth show the slightest sign of discoloration, it is time to go to the dentist, and promptly. We, of course, urge the yearly visit to the dentist and doctor for the preschool child, no matter how nearly perfect his teeth and general health appear to be.

Dental and medical problems can never be separated: they are all under the same skin. They are existent in the same physical organism, and when dentists and doctors cooperate another step ahead is taken.

You have to be able to diagnose common defects needing medical care and refer your patient promptly to the physician. Physicians have to acknowledge the necessity of dental oversight for every single child who comes to them for examination, no matter how healthy that child may appear.

Unbalanced diet, insufficient rest, unnecessary infections, these are all common enemies of childhood—we see their end-results all too often.

Both physicians and dentists must teach their patients more about diet and habit training if we are to overcome these drags on health, lessen morbidity and decrease child mortality.

We are also very positive in our advice to parents in regard to the care of the teeth before tonsil and adenoid operations. There are many children who don't do well after the removal of tonsils and adenoids. We cannot quote any statistics along that line, but we feel that, with the children who drag along with fever and slowly healing throats after operation, bad teeth may be a large factor. It surely does not sound reasonable to operate on a throat when there are decayed teeth and often gums oozing pus. Yet it is frequently done. "See your dentist first" is our unfailing advice with children needing tonsils and adenoids removed. We would like your help in this, too. Also, you have excellent opportunity to ask for a medical examination of your small patients when you find obstructive or diseased tonsils and adenoids. I presume that you diagnose this condition daily, but do you *urge* medical care? It seems to me that you do not so often as you might, but perhaps I misjudge you. I have asked many mothers who have taken their children to their dentists and had work done if the dentist did not say something about the child's nose and throat, and they assured me that he made no mention of the presence of the obvious tonsils and adenoids.

I judge that the question as to when to remove teeth is sometimes nearly as acute as the question as to when tonsils should be removed, but surely all are agreed that pus is an indication for the removal of either. I find swollen, tender submaxillary glands extremely common with decayed teeth and gums exuding pus, and swollen, tender, cervical glands with "cheesy" cryptic tonsils. If, as is claimed by some, 90 per cent of the nonspecific cases of arthritis are due to infection of dental origin, a clean mouth is a matter of no small importance. Study of focal infections has certainly done much to put dentistry in its own important place, and the good work should be carried on.

Dental sins are no greater or more numerous than medical sins, I willingly grant, but it seems to me that as your specialty is a definite entity, there is perhaps a little less excuse for your "sins" and a much easier way of overcoming them. So I shall say a few hard words about them and hope to be generously criticized if I am wrong.

In dealing with preschool children in Massachusetts, we have the following ex-

perience constantly. I think I may say that we have it practically every week in the year in which we have conferences. Over and over again, the mother says that the dentist tells her one of these things, or all of them.

1. The baby teeth do not matter.

2. It is not worth while to work on first teeth—they are going to come out anyway.

3. He does not wish to do children's work; which is, of course, all right, though regrettable. But no reference is given to a dentist who does do children's work. And in one case, when the mother asked for a reference, she was told to "quit worrying—leave the child's mouth alone and he'll be all right."

4. There needn't be any worry about the child's refusing solid food because his teeth hurt him. If he drinks plenty of milk, solid food does not matter and he will "soon have his second teeth anyway."

5. Decayed first teeth do no harm.

One mother went to three dentists in three different towns before she found one who would clean up her preschool children's decayed teeth and their gums, which were exuding pus. "I don't do children's work. I am too busy," said Dentist Number One. "You don't need to bother about those teeth, they will fall out pretty soon anyway," said Dentist Number Two. Number Three said, "Oh, let them go until September. He can get fixed up at the school clinic." And only one of the three really examined the child's mouth and not one referred the mother to a dentist who would do children's work.

Why do dentists tell mothers these things and why do they refuse to do children's work and neglect to refer parents to dentists who do? One dentist told me frankly that in his case it was "because children's work was a lot of bother and didn't pay." So I suppose that is one reason sometimes, but knowing as I do many excellent dentists, I cannot feel that that is the most common reason. I feel sure that there is still a great lack of knowledge of the importance of prenatal and preschool dental care and diet and also lack of realization of the results of neglect (all due to lack of sufficient teaching in dental schools, perhaps). These things can be remedied by you, surely. You notice I am not discussing the sins of intelligent parents and others responsible for neglecting to give children a proper diet and to take them to the dentist regularly. I feel after all that we are largely to blame for this, too. We provide little or no training for parenthood in our schools, and we do neglect our teaching opportunities as doctors, dentists and nurses, so just for this time I am leaving the parents out of the picture.

I should like to put in a word for publicity. Why are doctors and dentists so afraid of being accused of advertising? Publicity has its lawful place in professions as well as in trades. Why don't you use more good printed matter and posters in your clinics and offices? Such material must be attractive, catch the eye and interest and suggest something positive. Our American public loves to be told what to do provided the suggestion is presented in a colorful and definite way—witness Campbell's soups, etc.! Suitable material is a great aid to the busy dentist. It emphasizes his diet and habit teaching and it does not need to be expensive.

SUMMARY

Three things need to be constantly emphasized with your patients:

1. The need of adequate prenatal care by physicians and dentists.

2. The importance of balanced diet prenatally and during lactation, breast feeding and preschool diet in producing children with sound bones and teeth.

3. At least yearly examination of every child by physician and dentist and prompt correction of all remediable defects. Such correction should include not only dental and other physical defects but also any habit defects that injure the child's health and hinder his physical and mental growth.

CONCLUSION

We present the child with an inheritance and environment of sorts. He responds with his one marvelous, never-failing reaction—growth. No matter what we do to him, he grows, up to a certain point. If we treat him so ignorantly or so carelessly that growth is balked, he dies. Grow he must, to live. Our task, then, is to remove all remediable obstacles from his path of growth. He will do the rest.

GOOD TEETH*

By CHARLES H. HENSHAW, D.D.S., Des Moines, Iowa

UNTIL very recent years, the dental profession has devoted almost its entire effort and research work to developing the art of repairing decayed teeth and restoring lost teeth. Preventive dentistry has consisted mainly of brushing and cleaning.

Statistics show that from 90 to 95 per cent of all children in the United States suffer from dental decay. Many children 3 and 4 years of age have been found with twenty-four cavities in their twenty baby teeth. Recent examinations compared with surveys made ten years ago indicate that dental decay is on the increase.

What can be done to prevent this increase? Do we know the cause?

For answer to these questions, let us build a house, as an illustration, and compare it to building our teeth. The first thing is to select a lot. If the house is to stand, the ground must be solid. It must not be like the house built on the sand, mentioned in the Bible. This lot represents our ancestors. If they have had good teeth, we have a much better chance to have good teeth.

On the lot, we build a foundation. Again, this must be a good, strong foundation, and must not allow water to seep through. It must be a good, healthy foundation. In our story, this will represent the mother. If she is healthy and strong, her children are more apt to have strong bodies and strong teeth.

Now, we begin to build the house. If we want a good house, we must select the best of material with which to build it; good lumber, good nails, good plaster, etc. This is the good food that mother eats before the baby is born and while she is nursing the baby, and also the food that she gives to the baby after the nursing period.

The carpenters, brick masons, plumbers, etc., must use the greatest care in building the house. The boards must be cut right, the nails driven properly, the bricks laid straight and the plaster mixed smoothly. This is the great care that

*Radio talk broadcast during the Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 20, 1928.

the mother takes to keep the baby well; for all sickness, fevers especially, weaken our bodies, and rob our bones and teeth of strength.

Then, suppose that the house is finished, and no one sweeps the floors, the garbage man empties his cans all over the house, the windows are broken without being replaced, and the house is allowed to run down. Our house will be kept spick and span, for, in this story, this is the baby grown up, and he uses a toothbrush night and morning. He chews every bit of food well, for, after all, food chewed well will clean the teeth better than all the toothbrushes ever made. The broken windows are the decayed teeth. We shall have them broken in spite of everything that we can do, but we shall have less breakage if we have good glass, and take good care of it. The repair man for the decayed teeth is the dentist.

Now, someone tries to spoil the story by saying, "My mother and her mother had bad teeth, my lot and foundation are both bad, so what is the use of trying?" That is all the more reason that you should try. Use greater care than ever, to build strong bodies, bones and teeth for your babies. Drive pilings in your lot to build your foundation, and excavate around your foundation. Put in tile and waterproof the outside. Use greater care than ever to eat the foods that will build strong bodies, bones and teeth.

What are all the good foods that we have been talking about? First, and most important for the mother, both before and after the baby is born, and for the baby after the nursing period, is milk, good, clean milk, that you are sure comes from cows that are not tuberculous. Then, the citrus fruits, leafy vegetables, red meats and all fresh vegetables.

When we are talking about babies, there is another thing which must not be forgotten, and that is sunshine. The baby must have sunshine the year round. In this part of the country, where we have long winters, we should ask our physicians to tell us how to take cod liver oil, which supplies for us the same essentials that sunshine affords.

WHAT DENTAL HYGIENISTS CAN DO TO RAISE THE STANDARD OF DENTAL CERTIFICATES

By W. R. WRIGHT,† D.D.S., F.A.C.D., Jackson, Miss.

THE dental hygienist's responsibility in raising the standard of dental certificates is one of the most perplexing problems confronting the mouth hygiene worker at this time. It is a question that raises other questions not yet solved by the dental profession, but if we will pin our faith to the fairly well established idea that where there is a will, success will come, also that right will usually win out; and add to this patience, perseverance and, above all, tactfulness, most of us will live to see fairly satisfactory results from the certificate plan.

While hygienists are a potent factor in raising the standard of dental certificates, they should understand some of

*Address before Mississippi Dental Hygienists Association, Jackson, Miss., April 22, 1929.

†Member of Mississippi State Board of Health.

the problems confronting dentists in this connection. They should appreciate the responsibility which they bear to their patients while dealing with both children and parents, and realize that often compromise seems better than total failure. This will explain in part why those in charge of the work have permitted unsatisfactory mouth condition to go unchanged.

To elaborate: To fix a standard for an "O.K." mouth that will suit the ideas of even a majority of the dental profession seems impossible at this time. It is not necessary to enumerate the reasons for this except to say that the profession has many varying ideas regarding the handling of temporary and permanent pulpless teeth. The dentist is forced to take into consideration the dental intelligence of the parents and their financial ability, to say nothing of the cooperation of the patient. When the first mouth hygiene program was started in Mississippi, any substantial improvement gained over previous conditions was hailed with such joy that little attention was then paid to what we know today to be glaring defects. Everyone feared that to be too strict in issuing certificates would mean failure of the work. However, much good has been accomplished under the present plan. We owe much to the pioneer work done, and we should not be too critical, for we may find, after many years of experience, that other revisions will be needed to keep abreast of the times.

Then, we must remember that high-pressure, hurry-up methods have been used to create interest, such as offering fair tickets for O.K. mouths, pitting one school against another, placing time limit on certificates, etc. While these practices have aroused enthusiasm and brought some good results, they have undoubtedly lowered the standard of dental certificates, for some dentists have issued certificates rather than lose their patients, hoping later to complete the work. Then, the unethical practitioner, ever ready to advertise himself, tried to see how many certificates he could write his name on and has had a full share in bearing the standard still lower.

The hygienists occupy a strategic position in raising the standard of dental certificates in that they teach both the child and the parent the value of teeth and their importance in relation to good health, especially as to the early care that is necessary. They are well within their rights when they drive such arguments home with all of their ability, for it is only through educational work that standards will be raised.

Hygienists must agree that the part which they will play in raising the standard of dental certificates depends largely on the cooperation which they will get from the dental profession, and while dentists may fail to agree on many important points in handling their work, at least a majority will be in accord with and support the hygienists. Through their skill, knowledge of mouth hygiene, faithfulness and, above all, tactful methods will come the goal that we all hope for. They occupy a key position to the situation, which they must not fail to realize.

In conclusion, let me say that the dental profession appreciates the dental hygienist and the service which she renders, and as long as she upholds the high standard of our profession she can expect the support of the dental profession in all her professional efforts.

LAST CALL

C. B. Fowlkes, as chairman of the Oral Hygiene Publicity Committee for the American Academy of Periodontology, has only a

few copies left of the newspaper articles which were developed by the Academy. If there is a demand, he can still obtain a few more at this time, so it is suggested that those interested write him at once at 2 East 54th St., New York City. After this supply is exhausted, there will be no more "advance copy" material.

These newspaper articles have excited much favorable comment and have helped to solve the newspaper publicity problem for many dental societies. It may be of interest to know that this present series has gone into the following states and countries: Alabama, Arkansas, California, Florida, Georgia, Indiana, Illinois, Iowa, Kentucky, Louisiana, Mississippi, Maine, Montana, Massachusetts, Michigan, Maryland, New York, North Dakota, New Mexico, North Carolina, New Jersey, Oklahoma, Oregon, Ohio, Pennsylvania, Tennessee, Texas, Utah, Virginia, West Virginia, Washington, City of Washington, Wisconsin, Canada, British Guiana, Switzerland, Greece, Sweden, Egypt, Hawaii, Australia, Argentine. In Honolulu, they are to be translated into the Japanese, Chinese and Korean languages for publication.

The Academy is making a very small charge of five dollars for these articles, which only covers the cost of arranging the series. On the committee which developed these articles were Arthur H. Merritt, New York; Gillette Hayden,† Columbus, Ohio, and C. H. Schott, Cincinnati, Ohio. This committee served without charge. A small fee was paid to S. B. Herben, M.D., who was former publicity writer for the New York Tuberculosis Association.

BOOK NOTICES

Among the recent reports pertaining to mouth hygiene activities is a very interesting and complete report, in pamphlet form, entitled, "A Survey of Community Dental Facilities in Cincinnati and Hamilton County." This was compiled by the Cincinnati Mouth Hygiene Council of the Public Health Federation, under the direction of Anna M. Drake, R.N., who is assistant secretary of the Public Health Federation. Such topics as "The Need for Dental Hygiene," "Dental Service in Hospitals, Dispensaries, Clinics and Health Centers," "School Service," "Dentistry for Children in Industry," "County Dental Service," "Service in Institutions," "Adult Dental Service," and "Dental Education," are dealt with in a thorough and interesting manner. This report should be in the hands of every one interested in community mouth hygiene problems.

Of considerable value to those interested in mouth hygiene activities is a recent book, entitled, "A Brief History of Mouth Hygiene in Cleveland," by Harris R. C. Wilson, D.D.S. A careful résumé and analysis of events in Cleveland's mouth hygiene history from the beginning of such activity to the present time is given. Much of the original Marion School Clinic Report is also included. The book is well and interestingly written and is a valuable contribution to the cause of mouth hygiene.

†Deceased

HATS OFF TO HAWAII!

The Territory of Hawaii is fully alive to the importance of mouth hygiene in its relation to health. This has been recently demonstrated by the action of its Legislature which has just appropriated the sum of $152,420 for the "Dental Division" budget under the Department of Public Instruction. The excellent work which has been carried on in Hawaii is undoubtedly the cause for this financial recognition.

THE VALUE OF EXTRA MILK RATIONS

The Scottish Board of Health reports that giving milk rations to children in school has shown clearly that the additional milk promotes growth. More than 1,400 children 6 to 14 years of age selected from ordinary working-class homes were given milk in school during an experiment covering two years, and their average gains in height and weight far outdistanced that of the children who did not receive milk in school. They also showed a marked improvement in general health and appearance. Separated (machine-skimmed) milk seemed in this experiment to give practically the same results as whole milk except in the case of the 6-year-olds, who showed greater gains when given whole milk.—*U. S. Children's Bureau Notes.*

SICKNESS AMONG WORKING WOMEN OF GERMANY

Married women form 40 per cent of the gainfully employed women of Germany. The harmful effect on health of the combined de-

mands of employment, housework and the care of children is considered an important element in the great disparity between the amount of illness among gainfully employed women in that country and among women not so employed. The incidence of illness among the employed women is five to eight times as great as among those not gainfully employed. The sickness-insurance funds, in which membership is compulsory for all employed women and girls, report that the sickness rate for their women members is 23 per cent higher than for the men. The Society of Industrial Hygiene of Germany, at whose recent annual meeting these facts were disclosed and discussed, emphasized the need for more effective legislation to protect young workers and especially mothers with little children, and for welfare work with expectant mothers, infants, and small children.—*U. S. Children's Bureau Notes.*

DENTAL SURVEY IN PHILADELPHIA

The Philadelphia Mouth Hygiene Association, during the three weeks' period from April 8 to 26, conducted a survey of 10,000 children in the Fifth School District of Philadelphia. More than 100 dentists volunteered from one half a day to a full school week to cover the survey. There were thirteen portable chairs moved from building to building. The student dental hygienists from Temple University and University of Pennsylvania, fifteen from each school, worked one-half a day every day, recording and assisting in this examination.—*Pennsylvania Department of Health News.*

A HEALTH CLUB IDEA

In a report from Miss Helen Friant, Temple University, '27, a very good health club idea is presented.

"I have organized health clubs in the fourth, fifth, sixth, seventh, and eighth grades of some of my schools. I give a classroom talk to arouse interest. Then I put it to the children about the club. They all must promise to try very hard to keep in the club. Then I organize. The club colors are pink and white:

Pink, for healthy gums; white, for clean teeth. They must remember the colors and be ready to tell what they are when called on. The club poem must also be memorized.

"Every morning when you rise,
You'll brush your teeth if you are wise
It makes no difference how you feel,
Brush your teeth after every meal,
Brush your teeth when you go to bed,
'Every night,' the dentist said."

I meet with the club every two weeks and have a short health program prepared. So far, I have used the following for classroom work: Story with poster: "Teeth—Structure and Use," "Gums—Exercising the Gums," "Foods to Eat for Strong Teeth and Bones," "Evolution of the Toothbrush," "Chew Sticks," "Compare the Mouth with a Garbage Pail."

I use a health chart and samples of toothpaste. I am urging the clubs to have 100 per cent buying new toothbrushes. I have also urged the parents to observe the children brushing their teeth twice a day, the other two times the children are supposed to clean their teeth without being watched.

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Pain: The clinical value of pain and the guidance afforded the dentist from either its presence or absence is discussed in detail by J. G. Turner (*Dent. Surgeon,* May 25, 1929). He says: "The dentine of temporary teeth is far less sensitive than that of permanent teeth. This difference is obvious whatever the age of the temporary tooth and is a great aid in using the drill on children. As a clinical guide, if you hurt a child when drilling a temporary tooth, beware of an exposed pulp. The dentine of the roots of permanent teeth is far less sensitive than that of the crown—and this, I think, is one factor in accounting for the success of certain obtundents. Healthy dentine in old teeth is liable to be just as sensitive as in young teeth, though I believe that

not infrequently the pulp continues to exercise its calcifying properties, irrespective of all external factors, till it is completely calcified and all nerve paths are closed. With, I believe, one exception, if decayed dentine is insensitive, it is dead. Pain on handling means that you have reached healthy dentine or the pulp." Caries may progress to utter destruction of the pulp and little or no pain be felt. Therefore, the slightest sensitiveness becomes significant. On the other hand, the advent of the carious process to the amelo-dentinal junction may be characterized by severe pain—toothache or neuralgia—as severe as might occur when the pulp is involved. This is referred pain. If pain occurs when the patient bites down upon a filling, there is in all probability decay progressing under that filling. Pain of long standing occasioned by eating may indicate the presence of a cracked crown. A hair's breadth of exposed dentin may lead to pain on contact with salt, sugar, heat, cold or touch. Even brushing the teeth is painful. Pulp pain is practically always due to the pressure of inflammatory exudation. Calcification producing pulp stones or secondary dentin is unusually painless, but there may be sudden sharp pain from a pulp stone that has been long in developing. Pulp inflammation may be relieved by application of cold in its early stages, while ordinarily the pulp is very sensitive to cold. The offending tooth may be located by application of cold. The pain may be continuous or may be intermittent, which may be due to accidental access of food or the rise and fall of local resistance. Referred pain, neuralgia minor, usually means an inflamed pulp, but may be due to dentin or even gingival pain. Tenderness and hyperemia of the part to which the pain is referred may make it difficult to convince the patient that his diagnosis is wrong. Unfortunately, referred pain gives us very little help in diagnosis. Pulp pain is generally due to infection of caries, but may also be due to infection gaining access through absorption, either to make way for other teeth or tumors, or to accompanying pyorrhea. The absorption of a deciduous tooth is usually accompanied by replacement of the pulp by granulation tissue or by vacuolation of its substance; but the pulp may remain vital and capable of producing pain or irritation up to the last minute. Chronic pulp inflammation may cause attacks of pain of extreme violence radiating along the distribution of the fifth nerve and extirpation of the nerve or extraction of the tooth becomes necessary. Acutely inflamed gums may cause severe pain, but often in chronic inflammation there is little or no pain and the observance of any slight tenderness becomes of importance. A small superficial ulcer may be very painful, while an ulcer covered with granulation tissue or a polypus or fibrous epulis may be insensitive. As to referred pain, conditions of the antrum or nose may be referred to the teeth, even in the lower jaw. Toothache may be an early symptom of glaucoma. Pressure on the trunk of the fifth nerve will result in pain referred to the periphery of the nerve. This pressure may be due to the presence of a tumorous growth, inflammatory exudation, granuloma or contraction of scar tissue. Inflammatory pressure may be due to syphilis. Rarely the pain of herpes is referred to the jaws. Closely associated conditions of adjacent parts may cause pain in the teeth, either by reference or by spread of the inflammation. Irritation of the cervical sympathetic nerve may cause "faceache." In one case, persistent pain, of no great severity, was the only symptom of epithelioma of the antrum for a long time. Numbness of the upper teeth may follow antral suppuration and numbness of the lower teeth has been known to accompany abscess of the lower jaw. In fracture of the mandible, numbness of the mental region may be a symptom. In one case, which the author characterizes as the worse case of pain that he has ever seen, pain was due to suppuration spreading from an abscess of a lower second molar along the inferior dental canal. Nothing, not even injection of morphin, relieved the pain, until the pus evacuated itself through the mental foramen. Among the anomalies of pain connected with extraction is the fact that a tooth with a live pulp can be extracted with but little pain but extraction of live pulp is an agonizing experience. Thus, it seems that the chief pain of extraction of a tooth lies in the surrounding parts, but if the tissues are healthy, there should be no great pain. An exception is in the case of the temporary molars, before the age of 3, with their roots widely divergent and of great length. Care in avoiding crushing injury, either of gums or bone, will go far toward avoiding after-pain. A very small bit of hard substance, such as the chip

of a tooth, may fret a small nerve and cause pain. A broken root end should be left alone unless there is deep pain and tenderness. True trigeminal neuralgia may be of dental origin, and when everything else is ruled out, the diagnosis is in little doubt. In conclusion, the author advocates the use of injection anesthesia in excavating for filling as conducive to better work, disagreeing with those who urge that loss of sensation may lead to undue exposure of the pulp.

Hereditary Ectodermal Dysplasia (Congenital Ectodermal Defect): A. A. Weech (*Am. J. Dis. Child.*, April, 1929) reports two cases in which multiple congenital anomalies were presented, the tissues in both cases having developed principally from embryonic ectoderm. In view of the fact that the defects as to hair, eyebrows, eyelashes, shape of brow and teeth were so nearly similar, it seems that the cause must have been the same in the two cases. In one case, that of the Jewish boy, aged 14, a brother had presented identical anomalies. Eruption of the teeth of the patient had been slow. At the age of 1 year, there was only one tooth in the process of eruption; at the age of 2, the corresponding tooth on the other side (upper incisor) had erupted. At the age of 6, there were six teeth; at the age of 11, one more tooth had appeared. Later, another molar erupted and was lost. The alveolar process was poorly developed. The four teeth in the maxilla were pointed, tusklike projections in the front of the mouth, spaced widely, inclined sharply forward and occupying the region normally taken by both incisors and cuspids. In the mandible, both cuspids were present, but no incisors. A molar of normal form was also present on the right side. In the other case, in a white girl, aged 7, there was deficiency of hair in the father and two of his uncles, who also had a deficient number of teeth. Dentition was complete in the patient at the age of 12 months, the first tooth appearing at the age of 5 months, and nine erupting up to the age of 1 year. The jaws were well developed in view of the fact that most of the deciduous teeth were absent and none of the permanent teeth had erupted. The Wassermann test was negative in both cases, and the children were normal mentally. Concerning the literature, the author has this to say regarding the dental aspect of the case: "Complete absence of all of the teeth, although exceedingly rare has been reported in several instances. The patients described by Guilford and by Strandberg were edentulous. On the other hand, patients with malformations of the hair and nails frequently display normal dentition, or the dental anomaly may be merely a tendency to early decay. Oliver and Gilbert's patients who exhibited combined defects of the hair and sweat glands had essentially normal teeth. More frequently, however, the teeth are markedly decreased in numbers, and apparently the lower jaw is much more apt to be edentulous than the upper. When the teeth are present, those in the front of the mouth are usually of abnormal configuration; molar teeth are of normal form. Thurnam's patient had only four molar teeth which were pronounced normal by his dentist. My second patient had four normal first molars, my first patient a single right rear molar of normal form. On the other hand, the teeth in the front of the mouth were frequently misshapen. In their case, MacKee and Andrews described the upper incisors as being 'somewhat gimlet shaped.' In both of my patients, all of the teeth in the front of the mouth were pointed so as to resemble canines; there were none with flat cutting edges. A decision as to whether the more lateral of the teeth should be classed as canines or incisors is therefore impossible. In Ascher's two patients, only three and two upper incisors were present. These teeth were described by Loewy and Wechselmann as being bottle-shaped. The authors have given illustrations of plaster models of the jaws of both patients; the illustrations show the teeth to be of exactly the same type as those exhibited by my patients. Teeth of this kind are nearly always inclined forward in the mouth. I was much interested to discover an article by Cole describing a combined defect of hair and teeth occurring in cattle. The incisor teeth of these animals (confined to the lower jaw in cattle), instead of being sharp and flat, were conically blunt and two few in number (two on each side instead of four). A published illustration of these teeth shows that they resemble strikingly those seen in the mouths of my patients. It would seem, therefore, that the cone-shaped incisor tooth represents a special form of anomaly particularly prone to occur in this group of cases."

Susceptibility to Cancer: Cancer never develops in sound tissues. It has been assumed in the past that cancer is due to an external

agency which enters into the human economy at the point of least resistance, such as a lesion caused by chronic irritation. New revelations would make it appear that cancer may be the result of agencies acting from within the body, due to biochemical dysfunction affecting the life history of embryonic cells. It is difficult to surmount the fact that when cancer has extended by metastasis to a new situation, it produces the histopathologic picture of the tissue in which it originated rather than that of the organ which becomes affected secondarily. If the disease were due to foreign invasion, it presumably would reproduce the type of cell of the newly invaded tissue rather than that of the primary seat of the tumor. In any event, it may be assumed that the agents which act on the cell to produce malignancy become an inseparable constituent of the cell, as metastasis in the human species takes place only by the transplantation of the malignant cell itself. One factor of supreme importance which has not been sufficiently stressed is that individuals vary in their susceptibility to the cause or causes of cancer, whatever they may be. In no other way can we explain why 90 per cent of persons do not have cancerous disease, and why 10 per cent of them die from it. It is logical to accept the hypothesis that the 90 per cent of persons have greater resistance to cancer than the 10 per cent, as to attempt to force an explanation of why only 10 per cent come in contact with hypothetic causative agents.—William J. Mayo, in *Am. J. Surg.*, May, 1929.

Advertising by Dentists: A dentist advertises otherwise than in the manner prescribed if he in any manner whatsoever advertises (a) the prices charged by him as a dentist; (b) any claim by him of personal preeminence in the practice of dentistry; (c) any claim of the use by him of exclusive apparatus in the practice of dentistry; (d) the use by him of special nostrums in the practice of dentistry. A dentist advertises if he exhibits or causes or permits to be exhibited his name on any preparation or article used for medicinal or dental purposes, and which is sold or offered for sale.—From the Dentists Acts, 1912-1927, in *Dent. Sc. J. Australia.*

Rheumatic Heart Disease in Children: The treatment of heart disease consists of adequate rest—of prolonged and complete rest, as the most important essential. The importance of a well-balanced dietary is considered. Drugs play a very small rôle. The foci of infection are to be removed when conditions permit. The need of prolonged regulation of activity cannot be stressed too much.—W. W. Belford, in *California and West. Med.*, May, 1929.

The Rheumatic Child: The author (N. G. Hill, *Brit. J. Child.*, October-December, 1928) examined 400 children, the majority of whom showed evidence of rheumatism or one of its manifestations. In all of them, the diagnosis of some form of rheumatism has been made before admission. Records were taken of the color of the hair and eyes, the texture of the skin, the condition of the teeth, the diet, the condition of the tonsils and the mental makeup. This investigation was made because of the impression that rheumatism was more frequently found in children with red or fair hair, with decayed teeth and with a particular mental make-up (emotional, bright and vivacious). As a result of this study, "no physical characteristics were found that were peculiar to rheumatic children other than those that were the outcome of the disease."—Abstr. *Am. J. Dis. Child.*

The New Childhood: Society protects its future in the child by throwing around it the arm of the scientific physician. The physician is the one in society on whom depends the application to the protection of childhood of all that is known, and consequently of everything that is really worth while in civilization. The physician has always been kind, sympathetic and helpful, but in the past he has often been ignorant, blundering and ineffective. Until science came to his aid, he fought blindfolded countless unknown enemies. With science as his aid, he faces enemies of known qualities. It is amazing how intimately we know the habits and actions of many organisms so small that millions of them could be balanced on a needle.—Ray Lyman Wilbur, in *J. A. M. A.*, April 20, 1929.

Use of Chewing Gum for Disinfection of the Oral Cavity: For several years, Weichardt (*Klin. Wchnschr.*, Feb. 19, 1929) experimented to find a preparation which would influence certain undesirable bacteria in the oral cavity. He observed that the mouth washes which were generally used for mouth disinfection did not yield the desired results. He studied the bactericidal effects of a colloidal silver chloride-silicic acid preparation. In order to make it more effective, he decided

to combine this preparation with chewing gum. He reasoned that through the prolonged chewing the bactericide would have a more intense influence on the mucous membrane. Twenty-six persons chewed this specially prepared gum for two hours or more. The bacterial flora of the mouth was examined before as well as after chewing and it was found that the number of germs had decreased to less than half their original number. Weichardt asserts that hemolytic streptococci, which are found in cases of scarlet fever, can be influenced even more effectively than ordinary bacteria; in a number of cases, they disappeared completely.—Abstr. *J. A. M. A.*

Industrial Dentistry: Industrial dental clinics were available in 1926 in the United States to more than 400,000 employes, and dental service was rendered by 164 dentists, forty-two dental hygienists, 100 nurses, and fifty-seven clerks. Two-thirds of all these dental dispensaries were an adjunct to or placed under the direction of the medical dispensary. This is as it should be because it is a part of a general health service, and a single administration is sufficient. Massachusetts, New York, Pennsylvania, and Ohio are the states where industrial dental service has been developed to the highest degree, probably because industrial development in all lines has progressed farther in those states. California has had but a sporadic interest in the problem. The California Raisin Growers' Association and the California Citrus Fruit Growers' Association have maintained clinics for a number of years. The Emporium, in San Francisco, the Oakland Mazda Lamp Company, the Southern Pacific Company and the Paraffine Paint Company have maintained dental clinics also. There has been no active development here, however, chiefly because the dental profession has not taken the problem up with the executives of plants or concerns where a large number of persons are employed. Some trade-unions in America have established dental clinics, but these are more commonly found in the East where foreign labor is employed, and the plan seems to be a modification of the European insurance system. This similarity is especially noticeable in New York, where the garment workers' unions employ their own dentist. A good many men look upon industrial dentistry as a disguised form of health insurance.—Guy Milberry, in *California and West. Med.*, January, 1929.

Palliative Treatment of Inoperable Cancer: Wild (*Lancet*, Nov. 24, 1928) says that during the last thirty-six years at the Christie Hospital, they have tried every suggested treatment for cancer which was properly brought to notice, and so far have not found that any drug, whether organic, inorganic, animal extract, serum or bacteriologic product, given by mouth, subcutaneously or intravenously, had any permanent effect in arresting the growth or preventing secondary deposits. Wild does not agree that cancer patients should be told the nature of their disease. When a patient knows that he has cancer, it is most desirable to hold out the hope of recovery, even to the last. The cachectic state which is present in most patients with advanced cancer should be treated by fresh air, tonics and alcohol. An open-air life in a mild climate is undoubtedly to be advised for all patients whose means and circumstances admit of it. The patient should be encouraged to continue his usual pursuits as long as he is physically capable of doing so. Any intercurrent condititon, such as indigestion or constipation, must be treated on ordinary lines, but as a general tonic, which often greatly improves the general health, Wild relies on small doses of arsenic with iron and ammonium citrate, and either calumba or gentian. If iron disagrees, the arsenic can be given with dilute hydrochloric acid and compound tincture of cinchona. Alcohol is often a most valuable adjunct to treatment, and in these patients there can be no danger of setting up alcoholic habits; it acts as a euphoric agent, relieves pain, and is a food which does not require digestion. Its use helps the patient to bear his troubles and prolongs his life by from four to six weeks. The amount need not be large to relieve pain. It is best to put off as long as possible the use of opium or morphine. In the early stages, acetylsalicylic acid is most useful and does no harm; 10 to 20 grains may be given every eight hours so long as it is effective. When no longer adequate it may be replaced by acetphenetidin or amidopyrine. When opiates are required, Wild prefers opium to morphine. Opium preparations made from watery extracts cause less digestive disturbance than the tincture.—Abstr. *J. A. M. A.*

Endocrine Treatment of Tooth and Jaw Diseases: The endocrine diseases are almost

always pluriglandular and this renders more difficult the choice of the therapeutic preparation to be used. (E. Muller, in *Deutsch. Zahnarztl. Wchnschr.*, February, 1928, p. 49.) Hypofunction of the thyroid occasions delayed dentition. The administration of thyroid tablets in these disturbances is suggested, but care must be taken here to begin with small doses and to use only a very reliable preparation, in order not to induce disturbing effects of hyperthyroidism: marked emaciation, tremor, pulse acceleration, glycosuria. Increase in thyroid function will principally influence dentition in the developmental period, where growth disturbances have been occasioned. The present status of the therapeutic experience and possibilities admits that it is possible, on the one hand, to exert a restraining effect on secretion, on the other, to have a substitutive effect in hypofunction by administration of normal organs or their products.—*J. Organotherapy*, November-December, 1928.

Decorative Reform in the Physician's Office: One group of offices outstanding for quiet taste and beauty has walls panelled in walnut. In the outer room, the secretary's desk is of period design. In one of the consultation rooms the flat topped desk is delightfully outfitted in brass. Exquisite electrical fixtures, lamps, comfortable chairs and couch complete a study worthy of the most fastidious home. These doctors affirmed that they had tried to provide an atmosphere in keeping with the class of people with whom they had to deal. Besides, they confessed, they liked such comforts for themselves. Much of their time was spent in their offices. Therefore, why not make them as beautiful as home? Each doctor visited had some humorous reference to make to the customs of the past. "I hope you notice," said one of these, "that we do not have a picture of a doctor seated at the bedside of a sick child." Doctors who admire the Italian influence in decoration will be interested in the effect achieved by a local physician. When the Medical Arts Building was in the process of construction, he engaged a suite for his office and had it decorated in the Italian manner. The walls are plastered in a deep cream color, with large blocks marked on the surface. The floor is some stone composition. The bare walls give a feeling of restraint and restfulness, and the few well chosen pieces of furniture are of dark wood upholstered in a warm rose. The austerity of the room is offset by the deep coloring of the fabrics.—Gladys Craig, in *J. Indiana State M. A.*

MISCELLANY

REVISION OF HARD CANDY LABELS CALLED FOR BY FOOD AND DRUG OFFICIALS

Manufacturers of hard candy have been warned by the Food, Drug and Insecticide Administration of the United States Department of Agriculture against the use of false statements on their labels as to the content of fruit, fruit juices or fruit flavor in their product. A notice urging immediate revision of faulty labels to comply with the requirements of the Food and Drugs Act has just been sent to makers of this type of candy.

The provisions of the law regarding labels, say the food and drug officials, are plain. They should bear no representations that are false, misleading, or deceptive in any particular; names or pictorial designs of fruit should be used only when that fruit, or its juice, is present in sufficient quantities to characterize the article. Otherwise, they say, if the candy contains merely fruit flavor, even though derived exclusively from the fruit named, the name of the fruit should be used only if qualified by the word "flavor" and without pictorial designs of fruit.

An exception is made as to flavors derived from the oils of citrus fruits. No objection is made to the name "Lemon Drops," or similar names, provided the labels bear no pictorial designs and no representations are made indicating an actual content of fruit or fruit juice.

Harmless acids added to fruit-type hard candies to enhance their fruity characteristics, according to the notice, are also to be declared on the label. Finally, the presence of synthetic flavors and artificial colors in the candy must be designated with the word "imitation" in type of the same size and prominence as the fruit name, in direct conjunction with it, and with the words "arti-

ficially flavored and colored" conspicuously displayed upon the label.

NEWS

California Association Honors Past Presidents: At the Thirty-Second Annual Meeting of the Southern California State Dental Association, held in Los Angeles, May 6-7, the association honored its past presidents by presenting them with past president's emblem of gold. Of the twenty-seven living past presidents, twenty-two were present to receive this honor.

School of Hygiene Named for Dr. Adair: The school of oral hygiene established by Dr. Robin Adair, who met his death in a motor accident April 26, and which was formerly known as the Atlanta School of Oral Hygiene, will be known hereafter as the Robin Adair School of Oral Hygiene in honor of its founder. John V. Pierson is the director of the school which offers training courses for dental hygienists.

Northwestern University Annual Home-Coming: The annual home-coming clinic of the Alumni Association of Northwestern University Dental School was held June 12-13 at the Montgomery Ward Memorial Building, McKinlock Campus, Chicago. Wednesday morning, June 12, was given over to various clinics, covering the specialties. The afternoon was taken up with papers on the various aspects of dental economics. The alumni-senior dinner dance was held in the evening at the Hotel La Salle. Anesthesia was the subject of the papers presented Thursday morning. Memorial services were held in the afternoon for the late Drs. Prothero and Williard. The program was completed by a paper on "Better Business Methods in Dental Practice," by Arthur D. Black, dean of the dental school. The alumni stag party, dinner and entertainment was held at the Hamilton Club in the evening.

Dr. Orban Returns to Vienna: Balint Orban, who has for the past two years been the director of the research laboratory of the Chicago College of Dental Surgery, serving also in the school as a teacher of histology and pathology, returns to Vienna, sailing from New York, July 4. Dr. Orban was guest of honor at a dinner given by the faculty recently and at the commencement exercises of the college. he was presented with the key of the honor society Omicron Kappa Upsilon. Rudolph Kronfeld, of Vienna, is the new laboratory director.

Eastman Dental Clinic Foundation Stone Laid: April 30 marked the ceremony of laying the foundation stone of the Eastman Dental Clinic, at 256 Gray's Inn Road, W. C. 1, London, adjoining the Royal Free Hospital. Invitations were issued by the Right Honorable Lord Riddell, president, Sir Albert Levy, vice president, and Mr. George Eastman. The foundation stone was laid by the Prince of Wales. Harvey J. Burkhart, director of the Rochester Dental Dispensary, Rochester, N. Y., represented Mr. Eastman, donor of both clinics, at the foundation stone laying in London. It is hoped to open the clinic in 1930. The primary object of the clinic is to provide dental treatment for children residing in St. Pancras, Holborn, Finsbury and Islington, but treatment and advice will also be provided for expectant and nursing mothers and a certain number of adults of other classes. To secure Mr. Eastman's gift, of £200,000 it was necessary to provide an endowment fund of £100,000 and also for the Royal Free Hospital to undertake the responsibility of maintaining and administering the clinic. The annual cost of maintenance is estimated at about £20,000. The £100,000 for the endowment fund was provided by the generosity of the president of the Royal Free Hospital, Lord Riddell, and its honorary treasurer, Sir Albert Levy.

Fraternity Issues Bulletin: The Alpha Zeta Gamma Dental Fraternity announces publication of the first issue of its bulletin, *Alpha Zeta Gamma Journal,* about July 1.

Government Dental College at Lahore, India: According to a recent issue of the *Indian Dental Review,* a dental college will be inaugurated in the very near future at Lahore by the Government of Punjab. Its establishment is hailed as the beginning of scientific dental education in India.

Mississippi Hygienists Elect Officers: At the first annual meeting of the Mississippi Dental Hygienists' Association, at Jackson, April 22, the following officers were elected: president, Leila Clements, Laurel; vice president, Emily McQueen, Meridian; secretary, Elizabeth Kimmons, McComb; treasurer, Aileen Cooper, Vicksburg. After adjournment, the hygienists were the guests of the Mississippi Dental Association in session.

Dr. Tavlin Government Appointee on Health Boat: Edna V. Tavlin, of Missoula, Mont., is acting as dentist on the government health boat which left Seattle May 20 for a five months' cruise up the Yukon. Her duties consist of dental treatment to the natives of Alaska, together with the teaching of preventive dentistry. Dr. Tavlin is the first woman dentist to secure this appointment.

DEATHS

Curtis, William W., Chicago, Ill.; University of Michigan, School of Dentistry, 1883; died recently; aged 65.

Siddall, Charles J., Kalamazoo, Mich.; University of Michigan, School of Dentistry, 1881; died suddenly, April 4. Dr. Siddall was the oldest practicing dentist in Kalamazoo.

ANNOUNCEMENTS

CALENDAR OF MEETINGS*

NATIONAL SOCIETIES

American Dental Association, Washington, D. C., Oct. 7-11, 1929.

American Dental Assistants Association, Washington, D. C., Oct. 7-10, 1929.

American Dental Hygienists Association, Washington, D. C., Oct. 7-11, 1929.

American Full Denture Society, Washington, D. C., Oct. 1, 1929.

American Society of Orthodontists, Estes Park, Colo., July 15-19, 1929.

Association of American Women Dentists, Washington, D. C., Oct. 7, 1929.

National Association of Dental Examiners, Washington, D. C., Oct. 5, 1929. George L. Powers, Secretary, Memphis, Tenn.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

July (1929)

California, at San Francisco (8-12).
Oregon, at San Francisco (8-12).
South Dakota, at Rapid City (1-2).
Utah, at San Francisco (8-12).
Washington, at San Francisco (8-12).
Wisconsin, at Milwaukee (9-11).

American Dental Society of Europe, London, England, July 29, 1929.

Dental Congress of Latin America, Rio de Janeiro, Brazil, July 14-21, 1929.

First District Dental Society of New York, Dec. 10-14, 1929.

International Dental Federation, Utrecht, Holland, Aug. 5-11, 1929.

Pacific Coast Dental Conference, San Francisco, July 8-12, 1929.

Southwestern Dental Society, El Paso, Texas, October, 1929.

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Arizona, at Flagstaff, beginning July 29, Eugene McGuire, Secretary, 420 Security Bldg., Phoenix.

Montana, at Helena, July 8-12. T. P. Regan, Secretary, Helena.

North Dakota, at Fargo, July 9-12. Gilbert Moskau, Secretary-Treasurer, Grand Forks.

Vermont, at Montpelier, July 1-3. David Manson, Secretary, Burlington.

SOUTHWESTERN DENTAL SOCIETY

El Paso, Texas, is the meeting place of the Southwestern Dental Society; the time, October, just prior to the meeting of the American Dental Association in Washington. We are desirous of putting on this program by members of the A. D. A. who live in the West and can arrange to stop off enroute to the Washington meeting. All members of the American Dental Association are most cordially invited to bring their papers, clinical material and dental ideas with them to help us make this a successful meeting. There will be golfing and a trip across the Rio

Grande to a real Mexican bull fight. Come and be our guests.

Address all communications to
L. A. NEIL, *Chairman,* Program Committee
809 First National Bank Bldg.
El Paso, Texas.

DECEMBER MEETING FOR BETTER DENTISTRY, FIRST DISTRICT DENTAL SOCIETY OF NEW YORK

The First District Dental Society of the State of New York will hold its Fifth Annual December Meeting for Better Dentistry at the Hotel Pennsylvania, New York City, December 10-14. The committee is arranging a meeting of the same standard as those of former years. Essayists and clinicians eminent in their fields are being invited and an announcement of their personnel will be made at an early date. The same plan of subscription will be continued. There will be a manufacturers' exhibit in the hotel during the continuance of this meeting.

JOHN T. HANKS, *Chairman*

ASSOCIATION OF AMERICAN WOMEN DENTISTS

Headquarters for the Association of American Women Dentists for the meeting October 7 will be the Carlton Hotel, Washington, D. C. A banquet will be given at the hotel on this date. Haidee Weeks, New Orleans, is president of the association, and Wilhelmina Yeretsky, Grand Rapids, Mich., secretary-treasurer.

MILDRED W. DICKERSON

AMERICAN DENTAL HYGIENISTS' ASSOCIATION

The sixth annual convention of the American Dental Hygienists' Association will be held in Washington, D. C., October 7-11. The Powhatan Hotel will be general headquarters.

HARRIET FITZGERALD, *Chairman*
Publicity Committee
Health Dept., City Hall
Berkeley, Calif.

AMERICAN SOCIETY FOR THE PROMOTION OF CHILDREN'S DENTISTRY

At the Annual Meeting of the American Association of Dental Schools, held in Chicago, March 25-27, the president of the American Society for the Promotion of Children's Dentistry presented the following recommendation which was passed by the Section on Preventive Dentistry and Oral Hygiene:

"Recognizing the fact that preventive dentistry is the highest type of professional service, and realizing that it reaches its greatest efficiency during childhood, and knowing that better dental treatment may be afforded the public by an improvement in the teaching of children's dentistry in our dental schools, particularly in requiring a definite amount of clinical training be made mandatory for graduation; I ask the indorsement of this group to the end that a study be made of the present situation in our dental schools, and that recommendations be made to the executive council as to the minimum requirement that may be expected of a dental school, that it may give its student body sufficient training in this all-important phase of dentistry."

In the promotion of children's dentistry, the logical beginning is in our dental schools, and I believe that this effort will eventually result in a tremendous increase in better dentistry for children.

Plans for the annual meeting in Washington are well under way and you will soon receive a definite announcement regarding our luncheon and other proposed activities at that time. It might interest you to know that aside from the attention that is to be given to the work in the Section on Mouth Hygiene and Preventive Dentistry, our group will present two main papers before the Section on Orthodontia on our relation to their special field.

If you are promoting children's dentistry in your locality and are anxious to help stimulate enthusiasm nationally as a member of this group, write to S. D. Harris, 2002 Eaton Tower for further details.

F. BLAINE RHOBOTHAM, *President*

DEDICATION OF DENTAL BUILDING, BALTIMORE COLLEGE

The dedication of the new dental building of the Baltimore College of Dental Surgery,

Dental School, University of Maryland, will take place in Baltimore, Saturday, October 5. This will be known as Alumni Day. Friday, October 4, will be Class Reunion Day. Sunday, October 6, will be Recreation Day. Monday, October 7—on to Washington, D. C., to the Annual Session of the American Dental Association. In the near future, a chairman will be appointed for each class to get his classmates together for a grand reunion.

HORACE M. DAVIS, *Chairman*
Dedication Committee
Medical Arts Bldg.

WALTER E. GREEN, *Chairman*
Class Reunion Committee
2958 W. North Ave.
Baltimore, Md.

PATENTS OF INTEREST TO DENTISTS

1537140. Dental unit, Percy Russell, Swarthmore, Pa., A. W. Schramm, Riverton, N. J., and R. S. Woodward, Jr., Haverford, Pa.

1537716. Denture, W. R. Twiggs, Cleveland, Ohio.

1538691. Manufacture of dental plates, Edward L. Dillman, Jamaica, N. Y.

1538692. Manufacture of dental plates, Edward L. Dillman, Jamaica, N. Y.

1538798. Dental injection tube, C. L. Grier, Milford, Del.

1538832. Method and apparatus for effecting gold or tin dental stoppings, Charles E. Luce, Stuttgart, Germany.

1538068. Lingual-bar pattern, Felix Tavi, New York City.

1539637. Dental instrument, Finn J. Bronner, Bradford, Pa.

1539253. Sanitary shield for dental instruments, C. W. Fuller, Yonkers, N. Y.

1539143. Denture, Jacob Petry, Pittsburgh, Pa.

1539428. Dental mixing slab, Theodore Romaine, Irvington, N. J.

1540300. Carrier for dental flasks, Bernard Altman, Pittsburgh, A. M. Fulton, New Castle, and H. C. Breese, Pittsburgh, Pa.

1540409. Dental mirror, Richard E. McCray, Fairmount, W. Va.

1541180. Dental casting machine, John E. Parkison, Seattle, Wash.

1540911. Toothbrush, Samuel Soneshein, New York City.

1542243. Tooth-cleaning implement, W. F. Heinzelman, Pittsburgh, Pa.

1542535. Artificial tooth, Lake H. Sprinkle, Brooklyn, N. Y.

1543545. Dental apparatus, Edward M. Boatner, San Antonio, Texas.

1543421. Crown-mounted porcelain facing element, Harold A. Cottler, Brooklyn, N. Y.

1543579. Dental hot air syringe, W. J. Lauer, Argyle, Minn.

1543518. Tooth-paste serving device, W. B. Ramsey, Atlanta, Ga.

1544005. Collapsible paste tube and closure therefor, John I. Hill, Mexia, Texas.

1544404. Toothbrush attachment, William L. Hummel, Chicago, Ill.

1545061. Investment mold box, Stanley E. Noyes, Los Angeles, Calif.

1544694. Toothbrush holder, I. G. Speidel, Buffalo, N. Y.

1545734. Attachment for dentures, Dayton Bumgardner, Chicago, Ill.

1546006. Attachment for dental plates, Dayton Bumgardner, Chicago, Ill.

1546221. Device for ejecting paste and cream from collapsible tubes, John A. Eriksson, Bloomfield, N. J.

1546480. Dental engine, Carl Denzel, Freiburg, Germany.

1546845. Scraping machine for toothbrush blanks and the like, G. E. Lindgren, Northampton, Mass.

1546768. Tooth protector, William Shermer and S. Hermann, Philadelphia, Pa.

1656423. Dental instrument, Frank L. Williams, Denver, Colo.

SOME RECENT BOOKS*

Available for Circulation from the

LIBRARY BUREAU

AMERICAN DENTAL ASSOCIATION

Appleton, L. T., Jr.	Bacterial infection with special reference to dental practice. Philadelphia, Lea & Febiger, 1925.
Appleton, J. L. T., Jr., & Bryant, C. K.	Laboratory guide in bacteriology. Philadelphia, Lea & Febiger, 1928.
Barail, L. C.	High-frequency in dentistry. Paris, France, La Verrerie Scientifique, 1927. (Pamphlet.)
Berger, Adolph	Principles and technic of oral surgery. Brooklyn, Dental Items of Interest Pub. Co., 1927.
Berger, Adolph	Principles and technique of the removal of teeth. Brooklyn, Dental Items of Interest Pub. Co., 1929.
Bilpodiwala, M. C.	Care of the teeth, or layman's handbook of dentistry. Bombay, India, Author, 1927.
Box, H. K.	Treatment of the periodontal pocket. Toronto, University of Toronto Press, 1928.
Broderick, F. W.	Dental medicine. St. Louis, Mosby, 1928.
Broderick, R. A.	Dental bacteriology. Outlines of dental science. Vol. 2. Edinburgh, Livingstone, 1926.
Broomell, I. N., & Fischelis, Philipp	Anatomy and histology of the mouth and teeth. Philadelphia, Blakiston, 1925.
Brothers, E. D.	Dental jurisprudence. St. Louis, Mosby, 1928.
Brown, A. J.	Dental metallurgy. Outlines of dental science. Vol. 11. New York, Wood, 1928.
Brown, W. L.	Endocrines in general medicine. St. Louis, Mosby, 1927.
Buckley, J. P.	Modern dental materia medica, pharmacology and therapeutics. Philadelphia, Blakiston, 1926.
Bulleid, Arthur	Textbook of bacteriology for dental students. St. Louis, Mosby, 1927.
Bunting, R. W.	A text-book of oral pathology for students and practitioners of dentistry. Philadelphia, Lea & Febiger, 1929.
Burchard, H. H., & Inglis, O. E.	Textbook of dental pathology and therapeutics for students and practitioners. Philadelphia, Lea & Febiger, 1926.
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AMERICAN DENTAL ASSOCIATION

Washington, D. C. October 7-11, 192›.

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In case your first choice cannot be made, indicate second and third choices. If none of your choices are available, the hotel manager will mail your application to the Chairman of the Halls and Hotels Committee and he will place your reservation in as favorable a hotel as possible.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, namely to occupy the room at time agreed on, please write or wire the hotel releasing it, in order that your room may be available for other members.

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